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DIE BEDEUTUNG DER FORSTÄSTHETIK FÜR DIE WALDERHOLUNG

The significance of forest aesthetics for recreation in forest areas.

von Ulrich Ammer und Ulrike Pröbstl

Lehrstuhl für Landschaftstechnik, Forstwissenschaftliche Fakultät der Universität München, FRG

FDC: 907.1: 907.2: (430.1)

SUMMARY

The numerous investigations carried out in the last decades in the Federal Republic of Germany in to the recreation behaviour of the forest visitors have shown that with sufficient development of the forest area the aesthetic appearence of the forest is of greater importance than providing for a large number of recreation facilities. Because of that, and also because technology and rationalization in forest management tempt to resort to schematic solutions, the term of "Waldschönheitslehre" (science of forest beauty), coined 150 years ago, has to receive more attention again. Starting out from the expectations of the forest visitors typical examples and their positive and negative solutions are described.

Keywords: Forest aesthetics, Recreation in forests, Silviculture and recreation.

EINFÜHRUNG

Die bewußte Gestaltung des Waldes ist keine Errungenschaft der modernen Freizeitgesellschaft, sondern geht bereits in das ausgehende 18. Jahrhundert zurück. Wegbereiter für die Forstästhetik war die Idee des Landschaftsgartens, die durch eine eigene Philosophie zu einer neuen Sicht von Natur und Landschaft führte. Zu den Vätern der Forstästhetik muß man vor allem den königlich bayerischen Forstmeister und Kämmerer WILHELM FRIEDRICH FREIHERR VON DER BORCH (die Ästhetik im Walde 1824) HEINRICH WILHELM RIEHL (1857) und HEINRICH VON SALISCH rechnen, der mit seinem Buch (Forstästhetik 1885) den übertriebenen Bestrebungen um eine rationelle Forstwirtschaft entgegentreten und eine Waldschönheitslehre gründen will. Allerdings konnten sich diese Bemühungen um einen an der Schönheit orientierten Waldbau gegen die Versuche jener Zeit, den Holzertrag zu maximieren, nicht durchsetzen.

Erst in den späten 60-iger Jahren kam, angeregt durch den zunehmenden Erholungsdruck auf die Wälder und auch als Folge der Landschaftsplanung, die Diskussion um die Pflege des Landschaftsbildes und um die Gestaltung des Erholungswaldes wieder auf. Trotz einzelner besonders herausragender Beispiele haben mancherorts die Rationalisierungsbestrebungen in der Forstwirtschaft mit schematischem Pflegeverfahren, wie

- Reihendurchforstung
- linienhafte, unorganisch geplante Rückegassen und

- "Herbstfärbung" der Bestände schon im Sommer durch Anwendung von Wuchsstoffpräparaten bei der Jungwuchspflege

die Bemühungen um einen schönen und abwechslungsreichen Wald negativ beeinflußt. Gelegentlich haben auch Wegeneubauten, Materialentnahmestellen oder einschichtige Reinbestände zur Monotonie beigetragen.

Heute, rd. 150 Jahre nach den ersten Bemühungen erhält die Forstästhetik wieder einen bedeutenden Rang, weil man erkannt hat, daß die Anziehungskraft des Waldes auf Erholungssuchende mehr von der Schönheit und Harmonie des Waldes selbst, als von einer Vielzahl sogenannter Erholungseinrichtungen abhängt. Aber anders als damals wird die moderne Waldästhetik nicht von persönlichen Erfahrungen einzelner Forstleute geprägt, sondern sie ist ganz wesentlich das Ergebnis wissenschaftlicher Untersuchungen, wobei sozialempirischen Studien ein großes Gewicht zukommt.

ERGEBNISSE SOZIALEMPIRISCHER FORSCHUNG

Erwartungen der Erholungssuchenden an die Ausstattung der Landschaft mit Wald

Aus vielen Untersuchungen der 60- und 70-er Jahre wurde ein relativ enger Zusammenhang zwischen waldreichen Gebieten und solchen mit hohen Besucher- bzw. Übernachtungszahlen ermittelt. Bei aller Vorsicht, die bei Generalisierungen notwendig ist, kann man bezogen auf die Bundesrepublik Deutschland sagen, daß der optimale Waldanteil unter Erholungsgesichtspunkten bei etwa 30 - 70 % liegt. Unter 20 % wird die Landschaft oft als langweilig bzw. eintönig, über 80 % als einengend und bedrückend empfunden (Abb. 1 und Tab. 1).

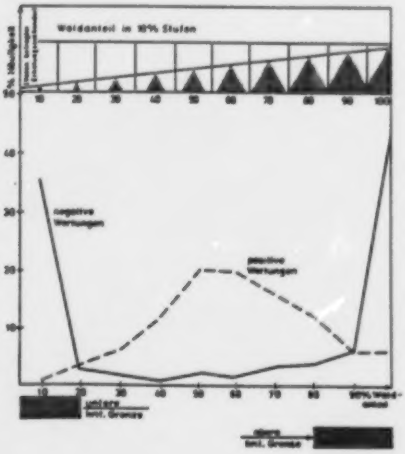


Abb. 1: Bedeutung des Waldanteils für die Erholung
Fig. 1: Meaning of percentage of forest areas for recreation

Raum u. Funktion	Walddichte in % der Raumeinheit		
	unterer Wert	optimaler Wert	oberer Wert
VERDICHTUNGSRAUM			
Hauptfunktion			
Wohnen	30	50 - 60	80
Naherholung	40	60 - 70	90
LÄNDLICHER RAUM			
Hauptfunktion			
Wohnen mit Industrie/Gewerbe	20	30 - 40 35	70
agrarische Produktion	10	20	30 - 40
Naherholung	25	50 - 70 60	80
Fremdenverkehr-Kurerholung	40	60 - 70	90

Tab. 1: Empfehlungen für die Ausstattung von Landschaftsräumen unterschiedlicher Funktion mit Wald
Tab. 1: Recommendations for the percentage of forest areas in different types of landscapes

Erwartungen der Erholungssuchenden an die Waldgestaltung

Aus verschiedenen Befragungen und Gruppendiskussionen (AMMER 1977, AMMER et al, 1981, KEPPLER 1986, PRÖBSTL 1988) ist bekannt, daß

- Natürlichkeit (Naturnähe)
- hoher Anteil von altem Wald (Altholz)
- Mischung aus alten und jungen Bäumen (Stufigkeit)
- Mischung aus Laub- und Nadelholz (Baumarten)

die wohl entscheidensten Parameter für die Attraktivität des Waldes darstellen. Dabei kommen den Kriterien "Natürlichkeit" und "Anteil an Altholz" die größte, der Baumartenzusammensetzung die relativ geringste Bedeutung zu.
Im Zeichen der Waldschäden erhält auch die Frage nach der Gesundheit der Waldbestände ein zunehmendes Gewicht.

Natürlichkeit, Pflegezustand

Die Hauptassotiation zum Begriff Wald ist Natürlichkeit und Ursprünglichkeit. Auch wenn bekannt ist, daß der Wald bewirtschaftet wird, soll nach Meinung des Waldbesuchers das Naturerlebnis im Vordergrund stehen. Spuren forstwirtschaftlicher Tätigkeit wie Wegeneubau, Holznutzung, Holzlagerung oder Kiesabbau, sollen möglichst nicht erkennbar sein. Von knapp 60 % der Befragten wird der Verlust an Natürlichkeit als das "Schlimmste" bei der Waldbewirtschaftung empfunden (Zielgebietsbefragung von BRÜCKNER 1976). Unnatürlich wirkt aber auch ein monoton aufgebauter Bestand in Reihen, aus einer Baumart und mit linearen Bestandesgrenzen. Trotzdem ist der ideale Erholungswald kein Urwald! Im Gegenteil, Naturwaldreservate mit hohem Totholzanteil werden als unordentlich und unästhetisch empfunden. Eine intensive Waldpflege wird also von den Waldbesuchern ausdrücklich begrüßt; sie sollte aber so erfolgen, daß sie nicht auffällt (PRÖBSTL, 1988).

Alter und Struktur

Von den Waldbesuchern werden Altholzbestände bevorzugt: je älter die Bäume sind und je stärker das Holz ist, umso "gewaltiger, mächtiger und erhabener" erscheint der Wald dem Besucher. Für viele sind jüngere Aufforstungen "kein Wald", erst recht kein Erholungswald.
Jüngere Bestände können aber durch sogenannte Überhälter wesentlich attraktiver gestaltet werden.
Von der Struktur her sind Bestände beliebt, in denen z.B. durch femel- oder plenterartige Nutzung verschiedene Baumgenerationen nahe beisammen stehen. Die Waldbesucher empfinden eine solche Struktur, die durch ein Nebeneinander sehr unterschiedlicher Altersphasen auf engstem Raum gekennzeichnet ist, häufig als harmonisch ("Vater-Mutter-Kind-Motiv"; HARTWEG 1976, AMMER 1977, 1978).
Diese Erfahrung wird übrigens auch von KOCH et al (1988) für die dänischen Waldbesucher bestätigt.
In der Therminologie der Waldbesucher werden solche Waldbestände auch als Mischwald bezeichnet.

Mischung und Baumarten

Mischung kann aber auch als das Nebeneinander verschiedener Baumarten (gleichen Alters) oder gar als das sich Abwechseln verschiedener Bestände (die jeweils nur aus einer Baumart bestehen) verstanden werden. Insofern ist der Begriff Mischung in der Sprache der Erholungssuchenden mehrdeutig!
Differenziert werden muß auch die Frage nach der Beliebtheit bestimmter Baumarten:

- einerseits gibt es so etwas wie eine Prägung von Landschaften durch bestimmte Bäume, die bei den Erholungssuchenden zu Assotationen führen wie: Fichte/Tanne und Schwarzwald, Eiche und Spessart, Birke und Lüneburger Heide, Buchenwälder in Dänemark;
  und sie wollen, daß solche Traditionen auch gepflegt und berücksichtigt werden.

- andererseits genießen bestimmte Baumarten - losgelöst von landschaftlichen Bezügen - bei den deutschen Waldbesuchern eine besondere Sympatie. Hierher gehören: Fichte, Eiche, Birke und - etwas abgesetzt - die Buche.

Daß der Erholungssuchende bei der Bevorzugung von Baumarten anders urteilt als der Forstmann und Ökologe, geht u.a. aus einer Untersuchung in den Isarauen bei München hervor (AMMER et al 1981): obwohl dort die Fichte natürlicherweise nicht vorkommt, wurde sie unerwartet hoch eingestuft. Offenbar gehört das Vorhandensein von Nadelholz mit zur Grundvorstellung von Wald. Hierzu trägt wohl auch die besondere Wirkung des Grünseins auch im Winter bei (Abb. 2).

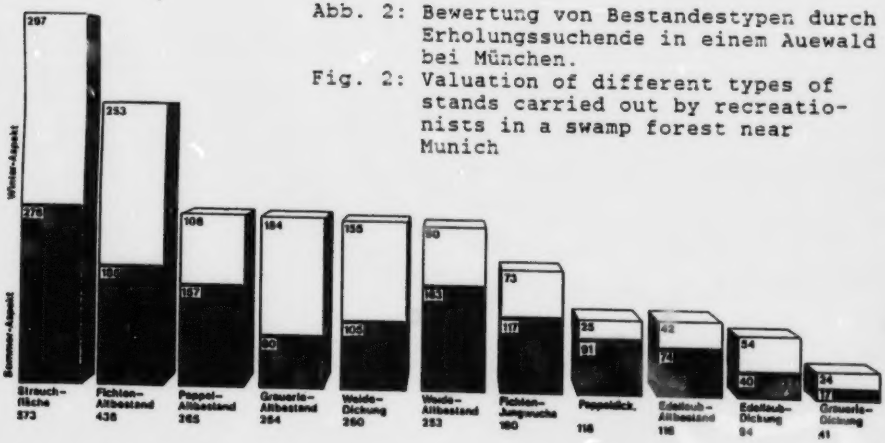


Abb. 2: Bewertung von Bestandestypen durch Erholungssuchende in einem Auewald bei München.
Fig. 2: Valuation of different types of stands carried out by recreationists in a swamp forest near Munich

In diesem Zusammenhang sind auch die Untersuchungsergebnisse von HARTWEG 1976 interessant, der für nahezu reine Fichtenbestände beides erhalten hat:

- hohe Präferenz durch die Waldbesucher (=Übereinstimmung der Profile Abb. 3a) und
- totale Ablehnung (=Auseinanderfallen der Profile Abb. 3b)

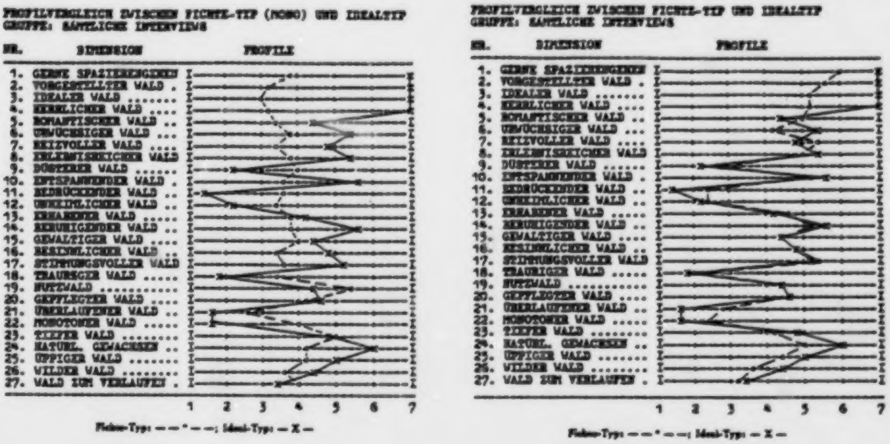


Abb. 3: Profilvergleich unterschiedlich aufgebauter Fichtenbestände (gleichaltrig/rein (mono) (a) und ungleichaltrig (b)
Fig. 3: Comparison of psychometric profiles of differently structured spruce stands (monostructured (a) and mixed structured (b))

Die Entscheidung der Erholungssuchenen war - statistisch signifikant - davon abhängig, wie der Fichtenbestand strukturiert war. Der monostrukturierte Reihen- bzw. Pflanzbestand wurde abgelehnt, der in natürlicher Verjüngung stehende ebenfalls reine Fichtenbestand wurde als ansprechend empfunden. Dieser Befund hebt noch einmal die Bedeutung des Waldbaus und der Waldpflege hervor und gibt dem Waldbesitzer und Forstmann eine große Freiheit für die Baumartenwahl unter produktions- oder schutztechnischen Aspekten, solange er es versteht einen differenzierten und vielfältigen Waldaufbau zu schaffen.

Vitalität des Waldes

Die Beobachtungen und Befragungen in stark von Waldschäden betroffenen Gebieten in Süddeutschland (im Fichtelgebirge und im Bayerischen Wald) zeigten, daß die Erholungssuchenden die Waldschäden relativ differenziert erkennen und daß der Erholungswert bereits heute beeinträchtigt ist (PRÖBSTL und AMMER 1990).

FORDERUNGEN DES FREIZEITMANAGEMENTS AN WALDPFLEGE UND WALDGESTALTUNG VON MORGEN

Über den Umgang mit Aufforstungen

Mit den strukturellen Veränderungen in der Landwirtschaft, vor allem der erwarteten bzw. vorausgesagten Aufgabe kleiner Landwirtschaften (insbesondere Zu- und Nebenerwerbsbetriebe) wird die Frage aufgeworfen, wie diese Flächen in Zukunft genutzt werden sollen. Verstärkt wird eine solche Tendenz durch die Programme und Überlegungen der Europäischen Gemeinschaft zur Flächenstillegung um den wachsenden Agrarüberschüssen entgegenzuwirken. Eine Möglichkeit diese Flächen zu nutzen, besteht in der Umwandlung zu Wald durch Aufforstung. In diesem Zusammenhang muß die Frage beantwortet werden, ob, wieviel und an welcher Stelle neuer Wald zugelassen werden soll. Dies ist nach sorgfältiger Analyse für jeden Einzelfall zu bestimmen, wobei vor allem die vorhandene Bewaldung, Größe und Form der Aufforstung, vorgesehene Baumarten, Relief und Sichtverbindungen eine Rolle spielen. Drei typische Fallbeispiele sollen die Problematik verdeutlichen.

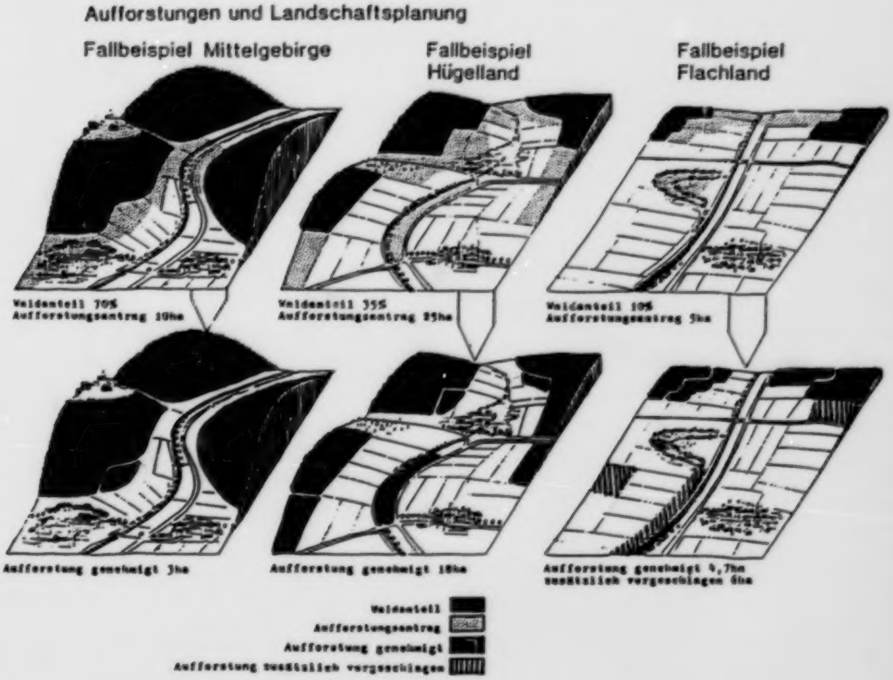

Aufforstungen und Landschaftsplanung
Fallbeispiel Mittelgebirge
Fallbeispiel Hügelland
Fallbeispiel Flachland
Waldanteil 70%
Aufforstungsantrag 10ha
Waldanteil 35%
Aufforstungsantrag 25ha
Waldanteil 10%
Aufforstungsantrag 5ha
Aufforstung genehmigt 3ha
Aufforstung genehmigt 18ha
Aufforstung genehmigt 4,7ha
zusätzlich vorgeschlagen 6ha
Waldanteil
Aufforstungsantrag
Aufforstung genehmigt
Aufforstung zusätzlich vorgeschlagen

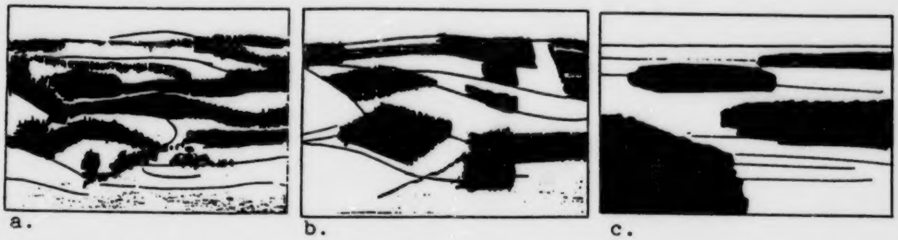
Abb. 4: Aufforstungen und Landschaftsbild
Fig. 4: Afforestation and landscape scenery (3 casestudies)

Fallbeispiel 1: Mittelgebirge
In den Mittelgebirgslandschaften ist durch die erschwerten Produktionsbedingungen in der Landwirtschaft erfahrungsgemäß mit umfangreichen Aufforstungswünschen zu rechnen. Dies zeigt auch das 1. Beispiel. Bei einem bereits hohen Waldanteil von 70 % gehen, würde man allen Wünschen Folge leisten, die ökologischen und ästhetisch interessanten Kleinstrukturen verloren. Dazu gehören der Uferbewuchs entlang des Fließgewässers, die Feldgehölze und die Pflanzengemeinschaften des angedeuteten Feuchtgebietes in der linken unteren Bildhälfte. Die waldfreie Kuppe mit Ruine würde durch eine Aufforstung ihre landschaftsästhetische Funktion als Orientierungs- und Aussichtspunkt verlieren. Auch die Aufforstung in der Talaue, die die drei bestehenden Waldflächen verbinden soll, würde das Landschaftsbild erheblich beeinträchtigen. Von den beantragten 10 ha können deshalb nur 3 ha genehmigt werden, die an den bestehenden Wald angrenzen und eine als harmonisch empfundene Abrundung bewirken.

Fallbeispiel 2: Hügelland
Im Hügelland liegt der heute vorhandene Waldanteil in der Regel bereits deutlich niedriger. Er beträgt in unserem Beispiel 35 %. Auch in diesen Gebieten wird sich die Erwerbsstruktur relativ stark verändern. Es ist zu erwarten, daß in steigendem Maße landwirtschaftliche Kleinbetriebe aufgeben, wobei nur die Flächen mit besseren Böden, dorfnah gelegen und nicht zu stark geneigt, von aufstockungsfähigen Vollerwerbsbetrieben übernommen werden. Für Streuwiesen, immer wieder überschwemmte Flächen in Flußnähe oder Steillagen werden daher bevorzugt Aufforstungsanträge gestellt, wie dies in Abbildung 4b mit 25 ha angenommen ist.
Hier erscheint aus der Sicht des Landschaftsbildes eine Erhöhung des Waldanteils durchaus wünschenswert. So kann entlang des Flusses bei entsprechender Baumartenwahl wieder ein Stück Auewald entstehen, der siedlungsnah und durch seine Artenzusammensetzung ökologisch wie landschaftsästhetisch eine Bereicherung darstellt. Die übrigen zugelassenen Arrondierungen sind landschaftsästhetisch mehr oder weniger neutral. Sichtbeziehungen im Tal oder Kleinstrukturen (Hangschulter) müssen aber offen bleiben.

Fallbeispiel 3: Flachland
Im Flachland ist als Folge der gut zu bewirtschaftenden Böden der Waldanteil gering. Er liegt oft - wie in unserem Beispiel - nur bei 10 %. Wenn überhaupt Flächen aus der landwirtschaftlichen Produktion herausgenommen werden sollen (meist sind es nur wenige Hektar) dann sind es nur solche, die weit von den Höfen entfernt liegen oder die, weil sie - wie in Abbildung 4c - an einen Altwasserarm grenzen, schwierig zu bewirtschaften sind. Man wird i.d.Regel den wenigen Aufforstungswünschen weitgehend zustimmen, allerdings mit der Einschränkung, daß das ökologische und landschaftsästhetische Feuchtgebiet um den Altwasserarm freibleiben muß. Da trotz der beantragten Aufforstung der Waldanteil noch weit hinter dem zurückbleibt, was aus der Sicht der Naherholung und des Landschaftsbildes wünschenswert wäre, werden im Beispiel zusätzliche Flächen für eine Aufforstung vorgeschlagen. Gerade inselartige Waldzugänge stellen in einer derart reliefarmen und ausgeräumten Landschaft eine Bereicherung dar (vgl. auch Abb. 5c).

Zusammenfassend ist festzuhalten, daß eine Zunahme der Waldfläche nicht nur aus ökologischen Gründen sehr häufig wünschenswert ist, sondern daß sie auch Vielfalt und Erlebnisreichtum einer Landschaft erhöhen kann. Voraussetzung ist allerdings, daß sich die Aufforstung dem Charakter der Landschaft einfügt, daß reizvolle Durch- und Ausblicke erhalten bleiben, daß geometrische Formen (vgl. Abb. 5b) vermieden und prägende Landschaftselemente (Flußlauf mit begleitenden Saum- oder Auewald) unterstützt werden und daß schließlich durch Baumartenwahl (im Rahmen des biotechnisch machbaren; vgl. hierzu auch AMMER und PRÖBSTL 1988) und Technik der Aufforstung (Vermeidung des Holzackereindrucks z.B. durch Aufbau von Waldrändern) soviel Natürlichkeit wie möglich realisiert wird.



a. b. c.

Abb. 5a + b: Günstige bzw. ungünstige Formen der Aufforstung
Abb. 5c: In der Ebene bewirken Aufforstungen eine Zunahme an Struktur.
Fig. 5a + b: Favourable (a) unfavourable (b) types of afforestation
Fig. 5c: In plane areas afforestations lead to a better structure

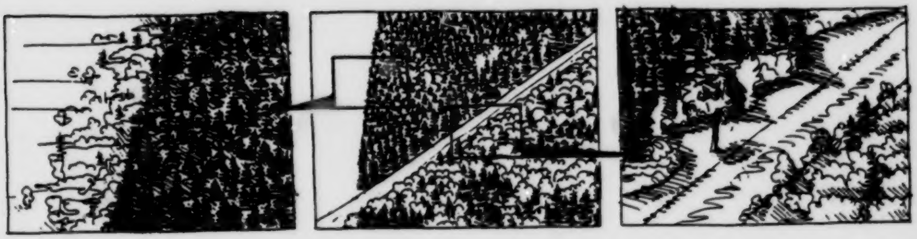
Waldästhetik trotz Forsttechnik und Rationalisierung

Bei dem gegebenen Zwang aller Waldbesitzarten zu wirtschaftlicher Holzproduktion können technische bzw. rationelle Verfahren der Holzernte und der Waldpflege in den meisten Fällen nicht einfach aus ästhetischen Gründen abgelehnt werden. Sofern sie ökologisch verträglich sind muß vielmehr versucht werden, den technischen und ökonomischen Vorteil zu nutzen und gleichzeitig ästhetisch negative Entwicklungen zu verhindern. Dasselbe gilt für die Verbesserung unbefriedigender Zustände in alten- bzw. mittelalten Beständen, weil in diesen eine grundlegende Änderung (z.B. eine andere Baumartenwahl) erst nach Ablauf der Umtriebszeit bzw. mit der Verjüngung der Bestände möglich wird. Probleme und Lösungsmöglichkeiten sollen an einigen typischen Beispielen aufgezeigt werden:

Waldränder

Waldränder können, auch wenn sie linear, monoton oder einschichtig aufgebaut sind (Abb. 6a), verbessert werden:

- durch die Auflassung (Nichtnutzung) eines Streifens vor dem Trauf gegebenenfalls Ergänzung durch Initialpflanzung oder Unterbau: (Abb. 6b)
- durch Anlage von Buchten insbesondere bei sturmgeschützten Rändern und durch Herausarbeiten einzelner Solitäre. (Abb. 6c)



a. b. c.

Abb. 6: Ungünstige (b) und günstige (a, c) Waldrandgestaltung
Fig. 6: Unfavourable (a) and favourable (b, c) management of forest edges

Räumungsformen

Auch wenn ein allmählicher Übergang in jüngere Altersstadien, wie es die Abbildungen 7a und 7b zeigen, durch femel- oder plenterwaldartige Behandlung nicht überall möglich ist, müssen nicht harte-lineare Räumungsfiguren (Säume) die Mißachtung der Waldästhetik schon von weitem anzeigen (Abb. 8).

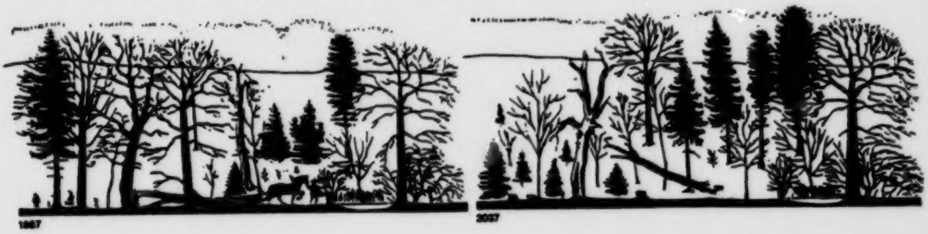


Abb. 7a + 7b: Fast unmerklich vollzieht sich die Verjüngung des Waldes.
Fig. 7a + 7b: Natural regeneration happens slowly and nearly unrecognizable for forest visitors

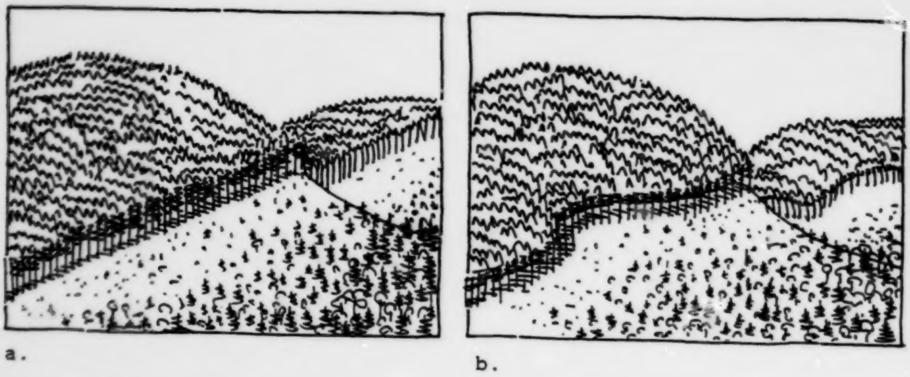


Abb. 8: harter, linearer (a) und weicher, gebuchteter Saum (b)
Fig. 8: straight, linear margin (a) indented, curved margin (b)

Das Belassen von Überhältern

Das Belassen von Überhältern auf Kahl- und Räumungsflächen erhält Struktur und ist häufig ein geeignetes Mittel um den raschen Verlust des Altholzes für den Waldbesucher abzumildern (Abb. 9a - c).

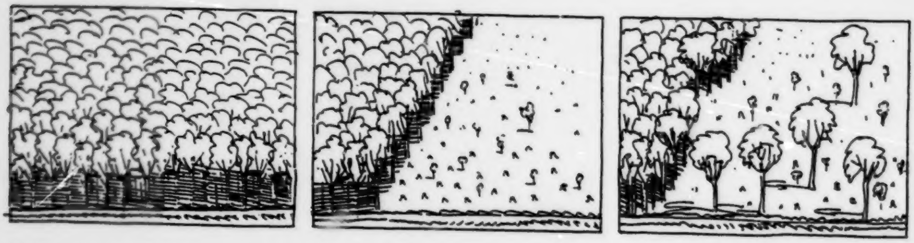


Abb. 9: Ausgangszustand (a), Räumung ohne (b) und mit Überhalt (c)
Fig. 9: Initial situation (a), cutting without (b) and with reservations of standards (c)

Pflege von Kulturen und Dickungen

Noch immer überwiegt die Pflanzung bei der Bestandesneubegründung und diese erfolgt fast immer in schematischer Form. Die Entnahme von ganzen Reihen bei der Pflege bzw. Durchforstung ist rationell, verlängert aber den fatalen Eindruck des "Holzackers". Individuelle Durchforstung bzw. Belassung des Laubholzes im Randbereich können hier sehr hilfreich sein.

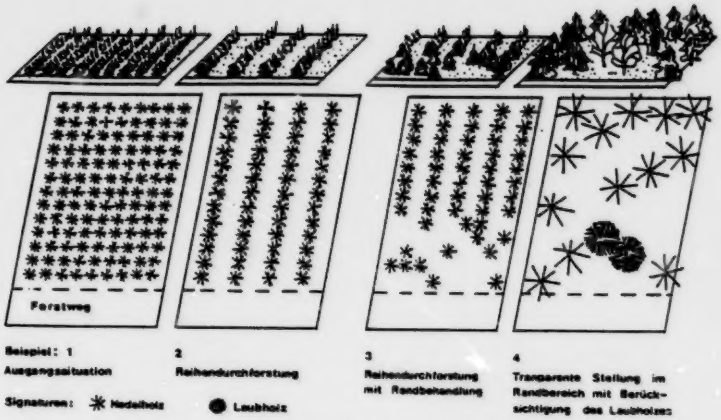

Forstweg
Beispiel: 1
Ausgangssituation
2
Reihendurchforstung
3
Reihendurchforstung mit Randbehandlung
4
Tranparente Stellung im Randbereich mit Berücksichtigung des Laubholzes
Signaturen: ✱ Nadelholz
● Laubholz

Abb. 10: Berücksichtigung ökologischer und ästhethischer Gesichtspunkte bei Reihendurchforstungen
Fig. 10: Row selective thinning with and without marginal treatment

Durchforstung und Rückegassen

Die Anlage von Rückegassen hat nicht nur die Holzbringung rationalisiert; sie hilft auch Rückeschäden und Bodenverdichtung (indem das Befahren der ganzen Bestandesfläche vermieden wird) zu verhindern. Aber diese Rückegassen müssen dem Betrachter bzw. Wanderer nicht in ihrer vollen Länge und Linearität vorgeführt werden!

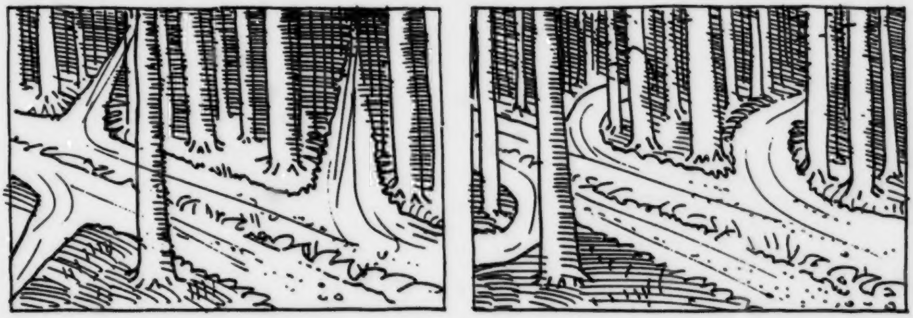


Abb. 11: Rückegassen müssen nicht linear und optisch störend sein.
Fig. 11: Extraction lines must not be linear and visually disturbing

Freiflächen im Wald

Vor allem in großen zusammenhängenden Waldkomplexen schätzt der Waldbesucher die freie, sonnenbeschienene Fläche. Diese Funktion kann z.B. von einer Kahlfläche, insbesondere wenn sie mit blütenreicher Krautvegetation bestockt ist, erfüllt werden. Besonders wirksam ist aber auch der Kontrast von Wiese und Wald; und hier bieten sich nicht nur viele Gestaltungsmöglichkeiten, solche Flächen erlauben zusätzlich eine Fülle von Freizeitaktivitäten (Lagern, Picknick, Ballspielen etc.) (Abb. 12).

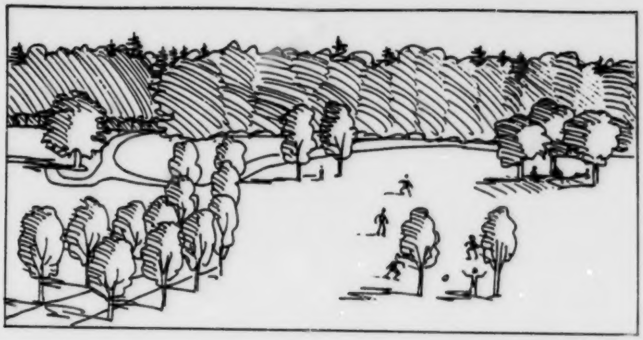


Abb. 12: Freifläche im Wald mit Gestaltung durch Einzelbäume (Allee, Solitär, "Torwirkung", Baumgruppe
Fig. 12: Glade with different arrangaments of single trees (solitary, tree lined avenue, group of trees)

Die Bedeutung von Einzelbäumen

Je größer die Zwänge zur Rationalisierung (z.B. größere Bewirtschaftungseinheiten, größere Hiebsanfälle) in der Forstwirtschaft werden, umsomehr müssen - gerade auf disponiblen Flächen, wie Wildwiesen, Holzlagerplätzen, Wegeböschungen etc. - die Möglichkeiten gesehen und genutzt werden, die sich aus der Plazierung und Komposition einzelner Bäume ergeben (vgl. auch Abb. 12).

ZUSAMMENFASSUNG

Die vielen Untersuchungen in den letzten Jahrzehnten zum Erholungsverhalten der Waldbesucher in der Bundesrepublik Deutschland haben gezeigt, daß der Ästhetik im Walde bei ausreichender Erschließung eine höhere Bedeutung zukommt, als der Anlage vieler Erholungseinrichtungen. Von daher, und weil Technik und Rationalisierung im Forstbetrieb oft zu schematischen Lösungen verleiten, muß der schon vor 150 Jahren geprägte Begriff der Walschönheitslehre wieder mehr Beachtung finden. Ausgehend von den Erwartungen der Waldbesucher werden für typische Beispiele positive und negative Lösungsmöglichkeiten skizziert.

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RECREATION AND ENVIRONMENTAL EDUCATION PROGRAMME AT THE "INSTITUTO FLORESTAL DE SAO PAULO" - BRAZIL

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FDC: 907: 945.2: (81)

SUMMARY

It is described the recreation and environmental education programme developed by "Instituto Florestal de São Paulo", utilizing interpretative trail, visitor center, pic-nic and sport areas, arboretum, animals observatory, playground, museum and nursery. The main objective is to integrate man with his social, cultural and natural environment, throughout the population consciousness about the nature preservation necessity.

Key words: recreation, environmental education, production unities, conservation unities

INTRODUCTION

Since Brazil's discovery in 1500, the continuous and the irrational devastation of its forests was and has been the principal factor of destruction of its flora and fauna resources, considered one of the richest on the earth.

According to Victor (1989), "because of its geographic position the Atlantic Forest was the first to feel the impact of man and today less than one percent of it survives. The Amazon Forest remained practically intact until the 1960s. From then on began a chaotic programme of occupation and development to fill the nearly empty region and assert Brazilian sovereignty".

In the State of São Paulo, the natural forests represent only 3 to 4% of its territory, and this fact has worried governmental offices, universities, investigation institutes and ecologic entities.

In this context, even before the environment policy have been established by the Government (Governo do Estado de São Paulo,1987), the "Instituto Florestal de São Paulo" develops a recreation and environmental education programme, in order to sensitize the population about preservation necessity of the various ecosystems threatned of extinction. In general, are utilized the interpretative trail, visitor center, pic-nic and sport areas, arboretum, animals observatory, playground, museum and nursery among others.

This paper presents a brief description of the characteristics of the production and conservation unities as well as of their usuary, verifying that the programme plays an important role in the integration of man with his social, cultural and natural environment.

PRODUCTION AND CONSERVATION UNITIES

The "Instituto Florestal de São Paulo" is a branch of the centralized administration of the "Secretaria do Meio Ambiente" of the State of São Paulo. Its function is to advise the state executive in elaborating the forest policy, covering basically three areas of activities: studies, preservation, and rational exploitation of forest resources. The recreation and environmental education activities are developed at the production and conservation unities, distributed in several points of the State.

Production unities

They are represented by experiment stations and state forests enclosing about 50,000 ha, from which 50% are covered by *Pinus* and *Eucalyptus* plantation. These areas maintained through sustained management guarantee the physical base for researches development. The extraction of resin from *Pinus elliottii* to obtain turpentine and pitch, has been economically important and about 4 millions trees are being resined annually.

Recently it was decided to implement recreation and environmental education areas in the unities situated in outlying urban or close to medium-sized cities, where the population itself demands new leisure areas.

Coservation unities

They are represented by State Parks and Reserves, and Ecologic Stations, enclosing about 700,000 ha. They have the following objectives: representative samples of all diversity ecosystems protection; genetic patrimony preservation; the flora and fauna resources protection; landscape of relevant natural or altered beauty cenics, maintained at supportable level for recreation and tourism preservation; hydric production preservation to minimizing the erosion and the sedimentation; means to educational investigation; studies and divulgation promotion about the natural resources, and cultural, historic and archaeologic values preservation.

These permanent preservation areas protected by law enclose different ecosystems: Latifoliate Forest, Araucaria and Podocarpus Forest, Tropical Latifoliate Forest, Tropical Rain Coast Latifoliate Forest, Mesophyte Subtropical Forest of Western and Meridional Brazil, Dune, Swamp, Salt Marsh Vegetation and Cerrado Vegetation (savana).

CHARACTERISTICS OF THE UNITIES

"Campos do Jordão" State Park

With 8,172.31 ha, it is one the most beautful and important parks of the State of São Paulo, and was the first to have a detailed management plan (Seibert et al. 1975). It has quite an irregular relief with altitudes that vary between 1,030 and 2,007 meters. The area possesses unique characteristic due to its location at the meeting of three floristic regions: the Araucaria and Podocarpus Forest, the Latifoliate Forest of the Atlantic Slope and the Brazilian Meridional Plains. In their two interpretative trails, "Cachoeira" and "Rio Sapucai", there are several points of landscape observatory. In the intensive zone there are visitor center, nursery, pic-nic areas, gardens, trout lake and lodging-house. In the primitive zone there is animals observatory.

"Cantareira" State Park

It is the principal state park located within the urban zone of the São Paulo metropolitan area. It has 5,600 ha and is covered with Tropical Rain Coast Latifoliate Forest. There are two trails, "Pedra Grande" and "Bica", visitor center, fish lake and museum. The management plan was made by Negreiros et al. (1974).

"Capital" State Park

It is also located within the urban zone of metropolitan area of São Paulo city, and since 1896 it has served as the headquarter of the "Horto Botanico" and still shelters administrative headquarter of the "Instituto Florestal de São Paulo". It is considered the principal leisure point of community from part north of the city. The major attraction is the "Octavio Vecchi" Museum, inaugurated in 1931 and considered one of the most complete of its kind. It has only 174 ha.

"Morro do Diabo" State Park

Located in the western region of the State, this park with 34,441 ha, contains the last remnants of the Mesophyte Subtropical Forest of Western and Meridional Brazil. To Coimbra Filho (1976), it is one the few habitats of the mico-leão (Leontopithecus rosalia chrisopygus), a species in extinction and of great scientific interest. At present, there is an unique trail with 1,100 meters.

"Carlos Botelho" State Park

It has approximately 37,000 ha and situated at the south of the State, is covered with Atlantic Forest. There are three trails and a visitor center. One of the principal botanical species is the Euterpe edulis, a comestible palmae. In this area are being conducted studies about "mono-carvoeiro" monkey (Brachyteles arachnoides), species in extinction. A relation of wild life with the most interesting points of the trail, and one of the most frequent forest species in this area were described by Dias et al. (1986).

"Serra do Mar" State Park

The most extensive state park has 309,000 ha and is covered with Atlantic Forest. It has besides two environmental education nucleous, "Caraguatatuba" and "Picinguaba", the most complete hydrologic laboratory for hydrographic basin management studies. Near the park is situated "Cubatão" industrial city, one of the most polluted of the world.

"Moji Mirim" Experiment Station

Located near urban zone of Moji Mirim city, it has 149.80ha. This unity possesses pic-nic areas, playground, visitor center, afforestation of Pinus and Eucalyptus, native species experiments and "cerrado" vegetation.

"Tupi" Experiment Station

Near Piracicaba city has 198.48 ha and possesses lakes, picnic areas, playground, visitor center, arboretum and natural forest. Valentino et al. (1982) concluded that the visitor consciousness is the most efficient manner for the rational use of a recreational area.

"Assis" Experiment Station

This unity occupies an area of 4,480 ha and is located at southwest of the State. In its area was implanted the first recreation and environmental education programme (Garrido et al. 1982). There are 5 interpretative trails, arboretum, visitor center, pic-nic areas, lakes for sportif fishing and swimming, and sport areas.

"Avare" State Forest

Located within urban zone of Avare city, it has 95.30 ha. The unique educative trail with 2,5 km of extension, possesses swamp, natural forest, arboretum of native and exotic species, and afforestation of Pinus spp, Araucaria angustifolia, Eucalyptus spp and Cupressus lusitanica. At the recreational area has visitor center, playground, kiosks, lake and thickets (Aoki and Souza,1989).

VISITOR CHARACTERISTICS

According to Beeton (1988) the quantitative data is necessary to determine existing visiting levels and trends, and the qualitative data to understand visit motivation and behaviour. Thus, the application of questionnaires is fundamental to know public's wishes, attitudes and feelings regarding the recreational use of forests and open areas; also, it is necessary to uniformize the questionnaire form, and a short list of questions is recommended.

Aoki and Doro (1989) applying questionnaires forms based in Heytze (1980), at Avare's recreational area usuary, verified that: a) the students are the principal usuary; b) the landscape is the major attraction; c) most of them go to the area for rest; d) they want a snack-bar; e) they prefer to visit area with friends, and f) the majority are from poor family and lived near the area.

At the "Campos do Jordão" State Park, Seibert et al. (1975) concluded that the tourists want: a) silence and isolation(44%); b) pure air (21%); c) landscape (18%); d) to feel the nature (15%); e) child recreation (12%), and f) leisure and rest (11%).

They would like to develop: a) wild animal observation (16.5%); b) walking (14%); c) pic-nic (12%); d) sportif-fish (12%); e) museum, arboretum and nursery visit (11.5%), and f) outdoor recreation with family (10%). The predominant ages are 30 to 40 years old (39%); 40 to 50 (31%) and 20 to 30 (17%); 10 to 20 represent only 2%.

At the "Carlos Botelho" State Park, according to Dias et al. (1986), the students are the principal usuary of the interpretative trail (95%).

Tabanez and Constantino (1986) show the influence of the implanted forests for the recreation and leisure of the low gains usuary at the "Assis" Experiment Station.

It was verified that while the "Campos do Jordão" State Park is frequented by high social level people, the contrary occurs at the "Capital" State Park.

The opinion survey carried out by Imanaga et al. (1989), whose respondents were high school students, university students of the faculty of forestry, agricultural technicians, forest researchers and forest economists, revealed the following points: a) many Brazilians selected beach and lakeside as their most favorite tour destination, and harmful animals in Brazilian forests seemed to deter people from walking in the forest; b) many Brazilians, even the young people, have strong mystic and holy feeling about trees and forests and deep primitive and religious emotion toward nature; c) there were only a few pro-hunting in Brazil; d) it seems that many Brazilians understand the importance of the forest management well, and e) young generation in Brazil the same as those in West Germany, Japan and Nancy favored the wilderness, but they understood the importance of forest management well.

The percentage who selected forest ranged was 11 to 24%, depending on the group. Thus, there is necessity to increment recreation and environmental education activities to sensitize the Brazilian community about the importance of forest resources preservation and their benefits. Besides, according to Stankey and Brown (1981), it is very important that recreation planners have at their disposal a framework that recognizes recreation as one element of an integrated forest system.

CONCLUSIONS

- the demand of leisure areas by population, stands out the necessity to develop studies, to sistematize methods and to evaluate results, in order to conduct adequately the recreative and educative activities;
- the environmental education introduced and taught to the primary and secondary education students, has permitted them to gain an understanding of the dynamics of their environment, and
- the establishment of recreation and environmental education programme can propitiate to the several segments of the population, the necessary comprehension about the natural resources

and to promote his integration with the social, cultural and natural environment.

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The Emerging Web of Integrated Resource Management

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SUMMARY

As competition for natural resources has increased over the past several decades, the debate about how forests and other lands should be managed to provide a variety of commodity and noncommodity values has intensified. In North America, polarization among public interest groups has been the result of this land use debate. In this paper, we discuss the need for a shift from a paradigm that emphasizes dominant resource uses such as timber harvesting to an ecosystem approach that features landscape, as well as stand level, integration of social values such as recreation, aesthetics, and subsistence with extractive resource uses such as timber harvesting and mining. We are at a juncture in the management of forests and related lands and must find new ways to provide a mix of commodity and noncommodity social values society desires. Failure to do so will likely lead to more pressure for single use allocation of lands, increasing public concern, and more political "solutions" to difficult problems.

Keywords: Integration, multiple use, recreation, silviculture, social values

INTRODUCTION

Integration: to join with something else; to unite

North American forestry has been blessed with abundance--an abundance which has permitted a very extensive brand of multiple use. With vast hectares of forests rich with natural resources and social values, a solution to land use conflicts has been land allocation to dominant use with multiple-use being the application of different dominant uses to subareas of large tracts of forest. Many uses in such a scheme are viewed as incompatible (e.g., recreation and timbering) and are often separated. Or in other cases, mitigation of the effects of timber harvesting has been attempted to provide for other resource values such as recreation, wildlife, and fisheries.

For both social and technical reasons, such approaches are no longer tenable. There are some forest uses that are incompatible (e.g., wilderness and timbering), but many are compatible and many uses are dependent on or at least compatible with other uses. Several forms of recreation, for example, depend upon the roads built for timber harvesting and on the openings which are created by harvesting activities (Clark et al. 1984).

In this paper we discuss several issues and concepts central to this change in the forest management paradigm. Our focus is on integrated resource management and research. We are aware that forestry in many other parts of the world follows a more integrated model than has been common in North America. We also are aware that in many parts of the world commodities are afforded the same dominant use status that they have been given in the USA and Canada.

We enter this discussion by examining elements underlying the current forest management paradigm. Then we suggest some ideas for a stronger focus on integrated resource management which we believe is needed and is in conformance with what many publics desire. Our ideas should be viewed as propositions because many of them have yet to be verified. Finally, we describe a case example of how recreation can be integrated with silviculture.

Our major interest is on how noncommodity uses, including many forms of recreation, subsistence, lifestyle, aesthetics, and cultural use, can be effectively integrated into land management activities. How can we effectively provide for the multiplicity of values inherent in these different uses? How do we provide wood, gas and oil, minerals, forage, and water while providing outputs that fulfill other social values? Below we hope to provide ideas for dealing with these and similar questions.

PARADIGMS ABOUT THE PAST AND FUTURE OF INTEGRATED RESOURCE MANAGEMENT

The state of our knowledge about how diverse ecological and social values of natural resources are interrelated and how they can be integrated through planning and management is at best incomplete. We have chosen to focus the major part of our discussion around elements of two contrasting paradigms related to resource integration. They provide a basis for discussion and evaluation of questions about multiple value integration.

The Dominant Paradigm Guiding Current Forest Management

A primary paradigm for forest management has been professional foresters making rational scientific management decisions. On the surface, this long-standing paradigm seems logical and right. Both parts of it, however, have been questioned over the past few years.

Forestry is recognized as a political as well as a technical activity. The political nature of it, especially for public forests, requires that decisions be made by those charged with the job of managing to achieve given outputs. Thus, interested publics and their representatives demand participation in forest management decisions (Wondolleck 1988).

While rational scientific management might best show how to achieve given ends, **it is not a process for choosing ends.** Other models such as those used in political behavior are designed for that purpose and lead to consideration of the values inherent in forestry decisions. Political processes decide ends; managers facilitate participation and evaluation of options. Thus, while rational scientific management is necessary, it is not sufficient to deal with the multiple value questions raised by critics of current forest management.

Additionally, not all models for management are rational scientific models and not all reasonable people think in rational scientific terms.

Forest management has been functionally organized and funded. Forest management organizations, especially government organizations, have developed around functional areas, often commodity or service oriented, with little organization focused on integrated or area management. Budgets also have been allocated to these functional areas, and cooperation and integration are left to a force known as coordination and might not be anyone's responsibility.

The result of such organization has been development of groups of staff foresters who are highly specialized and independently funded. They have had little incentive to work with other staffs (though some do anyway) and usually promote their area at the expense of other areas or forestry as a whole. These problems plague both planning and management because resource values and their relationships become separated over space and time.

Dominant use has been the practice, under the rubric of multiple-use. Since the 1950s, public forestry has emphasized timber management in most regions of the USA and in Canada. Grazing is more dominant in a few areas and recreation in a few others, but generally timber has been perceived as the primary value. Vegetation management, particularly, has been for wood fiber, with other outputs such as recreational opportunities occurring as byproducts. (We explore this relationship later in this paper.) This, of course, is not surprising when one considers that the functional staff that "pays the bill" is the timber staff. To cut more timber to raise more money requires a larger staff which in turn dominates the thinking of many forestry organizations.

A simple solution has often been provided to people who criticize the appropriateness of timber as a dominant use of forests. If one gives the critics their own dominant use areas they will be satisfied. Thus, a policy was born to carve forests into areas where different uses are dominant. Multiple-use was proclaimed by aggregating enough such areas to assert that over a large area, multiple-use was being practiced.

Such a policy seemed to be quite workable during an era of extensive natural landscapes. It was easy to "buy off" competing interests and it was easy to continue managing as usual. As forest resources have become perceived as increasingly scarce and as so much land has been allocated to dominant uses, such a policy has become increasingly challenged by those recognizing a more holistic nature to forest landscapes and the interrelationships of many forest outputs.

A boundary orientation has existed for forest management. Forests generally have been managed to the boundary of land ownership even though many resource values often transcend administrative or ownership lines. This has decreased opportunities for ecosystem, watershed level, and other large-scale approaches to resource management. Coordination across boundaries is difficult, but failure to manage whole forests leads to fragmentation, incompatible uses, missed opportunities, and arguments over management and property rights. The "boundary mentality" exists between research disciplines and academic institutions as well.

Management actions often have been viewed as discrete actions. A timber sale, a campground development, or a fisheries enhancement project have often been viewed as discrete activities. Looked at that way, the consequences of the action often are trivial. When viewed from a larger forest management perspective, such actions as they are accumulated across a landscape might contribute to significant cumulative effects over time.

Competition over land use has become increasingly polarized. Recognition of the potential for resource scarcity, and in some cases complete loss of a resource, dissatisfaction with functional dominant use, and other concerns about forest management have created an environment for polarization of interests. This splitting of interests and the attention it draws affects the land management opportunities that are considered. The focus becomes either this or that, rather than the variety of options available to meet the desires of a wide array of interested publics. Often not considered are various forms of vegetation management, the variety of standards for road construction and management, or the types of recreation which might be possible (Clark 1988).

Forest management has evolved in the USA over the past century. While we see the elements of the technical/rational paradigm about forest management reflected in most current practices, we also see variation in the way forests are managed at both federal and state levels. What fits one place does not necessarily fit another, and what is appropriate at one time in one place might not be appropriate at another time in the same place. In fact, we suggest that times are changing sufficiently to require a new paradigm for forestry in the 1990s that focuses on integrated resource management, where decisionmaking power is shared among interested parties and where multiple social values are incorporated into forestry management decisions.

Elements of a Paradigm About Forest Management for the 1990s

A major assumption behind the increasing call for a change in forest management is the belief that the pressures on the use of natural resources will increase, and increase at a faster pace than in the past. In addition, it is likely that demands for emerging social and cultural values will increase disproportionately as compared to traditional forest values. Recognition of the importance of recreation, aesthetics, wildlife, and other noncommodity outputs of forests will require a greater integration of multiple uses than has been practiced and will require the involvement of diverse interests in decisionmaking processes. Business as usual will not be accepted by interested publics. The following elements of an emerging paradigm are likely to become reality if present forest management organizations are to survive and interested publics are to be served.

A new paradigm is required for forest management which recognizes power sharing and the legitimacy of many social values, especially those emphasizing historical, cultural, wildlife, and recreational values. Professional foresters cannot be expected to represent all forest values and thus must share their decisionmaking power with others who hold different values. A distribution of outputs which more nearly equals the variety and distribution of values in society will be required, particularly for management of public forests. This change in emphasis must occur but does not necessarily require abandonment of traditional outputs. Rather, it might involve new approaches to achieve multiple outputs.

An integrated approach to management involving the integration of organizational structure, budgetary categories, disciplinary specialization, and management functions will emerge. To achieve the ends desired by a variety of interested publics, a focus on ecosystem and landscape level management with consideration for how multiple outputs can be obtained will be necessary. A focus on forest management, with the emphasis on "forest" (ranging from the landscape to the stand and to the tree), will be necessary.

Organizations which structure themselves to deal with the totality of forests will be more successful than others. This form of management will be designed to produce multiple outputs from single tracts of land, with full recognition of what is gained and lost with the management prescription selected. Particularly successful in this process are likely to be those professionals capable of spanning the lines of disciplinary boundaries who can visualize the existence, structure, and function of multiple output forests.

Integrated multiple-use will replace dominant use for a large portion of the forest landscape. Not all uses of forests are compatible and separation of uses, or dominant use, is appropriate in time and space in some situations. Many forms of use, however, are compatible and some require each other. Recognizing these compatibilities and dependencies opens options for management and for producing multiple outputs. The technical form of management often will be different for integrated multiple-use than for dominant use management, but many of the outputs, though sometimes in smaller quantities or spaced over a longer time, still will be produced. Integrated multiple-use calls for new and creative approaches to forest management, and this management might focus more on the human habitats which are created than on the commodities produced.

Boundaries will become less of a barrier in management decisions. Integrated multiple-use management which stops at administrative and ownership boundaries is unlikely to fulfill its potential when resource values transcend the boundaries (Agee and Johnson 1988). Thus, to practice integrated multiple-use management, agreements about management must be reached between adjacent land owners and managers. This will result in a blurring of boundaries and continuous integrated management across them.

Individual projects will be viewed in the context of landscape level systems. As noted previously, the cumulative effects of a set of discrete projects can cause significant impact and change. The only way to effectively deal with this phenomenon is to assess cumulative effects over a landscape and to make decisions in view of both site and landscape impact.

A middle ground in management prescriptions will be reasserted, thus lessening polarization. The polarization over forest management that currently exists is fueled by protagonists with uncompromising positions which are drawing attention away from many futures and management possibilities. Development of integrated multiple-use management will lead to many middle-ground alternatives for those forests where dominant use is rejected. As we begin to implement prescriptions for integrated multiple-use management, the possibilities for creating desirable recreation and wildlife habitats, timber, and aesthetic forests all on the same site will become recognized. And, for many lands, the middle ground will be reasserted and the polarization of dominant use rejected.

Actions will be undertaken to reduce traumatic impact on residents of communities and regions. Adoption of integrated multiple-use management for many forests, particularly public forests, will change relationships between forests and communities. Where this form of management is adopted, and where a greater array of social values are emphasized than at present, traditional outputs from forests are likely to decline. That may disrupt existing social and economic conditions and require intervention to soften the impact on residents. Assistance must be provided to communities for goal setting, planning, developing, and training so that they can adjust to new realities influenced by changing values of society and changing management of forests.

CONDITIONS FOR EFFECTIVE INTEGRATION

We believe the elements described above are fundamental to an emerging paradigm for the 1990s. They suggest that integrated multiple-use management will be implemented because people will demand that new values be emphasized in forest management. For effective integration the following seem to be necessary conditions:

1. A clear and comprehensive definition of what integrated resource management is and is not, and specific criteria for evaluating when integration has been achieved, are described.

2. Assumptions underlying integrated planning and management are clearly stated.

3. Desired futures are visualized and communicated in a manner so that people from diverse social and cultural backgrounds can understand where and when changes affecting them will occur.

4. Unambiguous multiple value objectives clarifying the desired futures are specified (Brown 1985, Prausa 1971).

5. Neighboring landowners and managers collaborate in defining desirable future conditions, their respective role in achieving them, and management prescriptions to follow. An ecosystem approach to providing diverse social values will be required to reduce fragmentation of key resources.

6. Professionals are open to new ways to manage for diverse values and to sharing power in decisionmaking.

7. Enough interested groups and individuals seek the middle ground to reassert its value. Polarization is disruptive and will result in solutions that limit the range of options.

8. Aggressive monitoring and evaluation and a willingness and ability to adjust to new information characterize managers. Management must be seen as an activity within a learning process.

9. Research to help professionals learn what works and what is ineffective is needed. Just as management needs to be broad and integrated, research needs to shed its myopia and fragmentation to focus on issues of social values, manager and public participation, landscape level management, and integrated multiple-use management. To be most useful, research must be conducted across agencies and at the landscape as well as site-specific level. Cross-disciplinary studies will be needed to improve our understanding of the interrelationships between multiple resource values and uses. There is a need for synthesis and interpretation of current knowledge from past research and management experience and demonstrations to test what does and does not work.

We have attempted to make a general case for integration as a preferred approach for providing a wide range of social values demanded by a changing society. Below we suggest some specific aspects of how recreation can be integrated with silviculture to provide high quality recreational opportunities.

THE CASE OF SILVICULTURE FOR RECREATION AND TIMBER

Whether intended or not, almost all forest management activities affect recreational opportunities and uses. The effects are not necessarily negative and depend largely on recreationists' preferences and expectations. However, effective multiple-use integration demands an understanding of the interactions among recreation and other uses of forested lands such as timber harvesting (Clark 1987).

In general, recreational opportunities (other than in designated campgrounds) in forests managed for multiple uses are incidental results of timber management. There has been little intentional planning to manage sites jointly for recreation and other resources (with the exception of visual resources). Where attempts have been made to provide for both recreation and timber, management experience usually has not been documented. We often do not know what the consequences have been, whether they were positive or negative, and for whom.

The overriding question is not whether recreation should be integrated with other resource uses, but where, when, and how such integration can be achieved. Unfortunately there are few specific guidelines and little detailed information to facilitate such integration, and few tested approaches for managing potentially incompatible uses at specific locations. There are, however, several concepts that can be used to address important questions about how effective integration can be achieved.

The Recreation Opportunity Spectrum (ROS) helps identify ways to provide recreational opportunities ranging from primitive and unconfined to intensively developed (Clark and Stankey 1979; Brown et al. 1978). It recognizes the potential compatibility between recreation and other resource uses for part of the recreational spectrum. In some areas, for example, timber harvesting may preclude most remote and natural recreational opportunities, while opening areas to people who do not mind evidence of roads and timber cuts. In other areas, opportunities for semi-primitive and undeveloped recreation may be possible in or near areas designated for logging or other resource uses if the scale of the project and how it is executed over time and space are modified to protect or enhance recreational values.

One approach to assessing impacts on recreational values is the Limits of Acceptable Change (LAC) model which attempts to determine acceptable levels of impact on various resources (Stankey et al. 1985). The LAC helps specify physical and social conditions that must be maintained to protect recreational and other resource values. It is applicable across the recreational spectrum and should prove useful when attempting to determine how much roading, harvesting, and other activities may be acceptable when providing different recreational settings.

Many of the concepts from the wildlife habitat literature (Thomas 1979) also apply to recreation. Several of these might be considered when managing for recreation habitats. Understanding these concepts could help silviculturists evaluate the potential effects of alternative prescriptions for recreational opportunities (Clark 1987, 1988). Several examples are described here.

> People have "home ranges." Resident populations tend to center recreation around the community; other users are migratory (tourists) and frequent sites well beyond the home ranges. It is important to think in terms of specific populations, rather than some vague, ill-defined public, when considering silvicultural options for recreation. Campgrounds also become "home" bases for recreationists and some of their activity spreads out from these nodes.

People are "territorial" and they form strong attachments to favorite and often-visited places and usually do not wish to see them changed. It is extremely important to identify the location of such sites before any on-the-ground management. Options for protecting or enhancing these places can then be evaluated.

"Site attributes" influence how people make choices and how they can use the forest. Some attributes constrain activities and others facilitate. Knowledge of how site attributes influence recreational choices can help in locating and designing silvicultural modifications.

"Hiding cover" is particularly important at campsites. People want privacy and quiet, and many try to separate themselves from other parties and from evidence of other resource uses (such as clearcuts and main roads). This seems to be as true for people in dispersed roaded areas as it is for people who prefer wilderness. Such isolation can be achieved by appropriate screening or maintaining adequate distances between recreation sites and other uses. Care must be taken when managing roadsides for visual concerns (for people driving through an area, for example), not to inadvertently destroy hiding cover at nearby campsites.

The nature and extent of change acceptable to recreationists varies. People have different expectations for "macro" versus "micro" sites, and the microsite seems more susceptible to adverse change; that is, management activities acceptable in the general area (such as evidence of logging or roads) may be considered intolerable at a campsite.

Habitats are "dynamic" with natural changes and human-caused disturbances influencing the nature of recreational settings. Indeed, the type and location of recreational activities can change with physical alteration. Such change can be managed both spatially and temporally to achieve goals of some recreationists.

The recreation habitat approach helps focus management on sites (present and potential) and helps evaluate how resource management activities will affect these sites and the choices recreationists make. A benefit of this approach is that it treats recreation at the same level of resolution as other resources and recognizes that recreation is part of a complex and dynamic resource system.

There are three basic challenges when attempting to provide quality recreation habitat: protect existing sites, enhance existing sites, and create new sites. Each requires information about existing and potential sites and recreationists' patterns, demands, preferences, and needs. Such management also demands close cooperation between silviculturists and other specialists, who should consider the role of the site, stand, and tree in current and future recreation.

When thinking about recreation and timber there is generally a range of silvicultural options in any given area: silviculture for recreation, with no timber consideration; silviculture for recreation, with timber as a byproduct; silviculture for both recreation and timber; silviculture for timber with recreation as a byproduct, and silviculture for timber, with no consideration for recreation. We believe that most past management falls into the latter two categories.

Silviculture's potential to enhance recreation should not be used as an excuse to log an area. But once a decision has been made to harvest timber, it might be possible to use silviculture to provide high-quality recreational opportunities as well. In other cases it might be more appropriate to develop silviculture prescriptions expressly for recreation (Clark et al. 1984).

Understanding of when and how recreation can be integrated with other resource uses requires identification of potential conflict and compatibility early in the planning process; only then can managers develop any short- and long-term integrative objectives for a particular area. Forest stand conditions change through time and may provide different benefits for different people at different times. Some users may inadvertently be disenfranchised unless managers recognize what a forest is providing, when, and for whom.

Integrated multiple-use objectives are essential because many, if not most, resource changes that affect recreation are outside the control of recreation specialists. The key is to make sure that both potential benefits and tradeoffs are made explicit before any action is taken (Brown 1985). And monitoring to insure that the desired effects occur is fundamental to success (Stankey et al. 1983).

The bottom line is that almost everything managers do, whether planned or not, will affect recreational opportunities. The public reacts to this reality as they anticipate or discover undesirable changes in areas they value. Professionals must have empathy and be sensitive to the fact that what they do affects people and their recreation habitats. Failure to do so will likely lead to further polarization and loss of manager credibility.

CONCLUSION

In the dark of night, when stumbling without a light down a rarely used trail, the ever-present spider's web is seemingly without purpose or organization. But, as dawn turns to light, the interdependency of the many strands is revealed in both their fragile beauty and function. So it has been and will be as we see the complex nature of integrated resource management unfold. The past has provided but a beginning to our awareness of how diverse resource values and uses are interrelated. The future will see an increasing understanding of how it is possible to achieve a variety of social goals on the same lands without sacrificing the quality of any one. As this new paradigm for forest management emerges, managers and researchers who develop and adapt it will lead forest management through the 1990s.

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NEAR-FUTURE TRENDS IN FOREST RECREATION: A CROSS-CULTURAL INQUIRY[1]

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SUMMARY

Paper identifies and defines changes occurring in many societies that could impact management and use of forest recreation areas. It also defines what those impacts might be. Forty-nine experts from 18 countries rated the likelihoods of those changes and impacts occurring by the year 2005. Results show both similar and dissimilar patterns of response among four groups of countries defined in the paper. The considerable emerging challenges to forest managers indicated by these results are discussed.

Keywords: forest recreation, planning, future trends, prediction

BACKGROUND

Much has been written recenty about the fast pace of change in modern societies. Examples include the books, The Third Wave (Toffler 1980), Megatrends (Naisbitt 1982), Thriving on Chaos (Peters 1988), New World-New Mind, (Ornstein and Ehrlich 1989), Beyond Our Means (Malabre 1987), The Third Century-American's Resurgence in the Asian Era (Kotkin and Kishimoto 1988), The Second Shift-Working Parents and the Revolution at Home (Hochschild 1989). Two central themes of these writings about social change are that individuals and social institutions must be able to adapt and that both need to "image" the future better.

Providers of public social services, such as forest recreation opportunities, have a particular interest in the future simply because they want to meet present needs when that future arrives. For that reason, recreation resource planners and managers spend considerable time predicting and estimating future patterns of use for different types of recreation opportunities and changes in variables (e.g., age, income, amount of leisure time) with which recreation demands have been historically associated.

The purposes of this paper are to: (1) identify and define changes in societies that logically could impact management and use of forest recreation areas by the year 2005; (2) solicit, report, and interpret judgments of the likelihoods of each change and impact from a panel of experts on forest recreation who represent a variety of countries; and (3) assess the impacts of each change.

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[1] Although we cannot list the name of the 49 respondents to our questionnaire, we do appreciate their help.

METHODS

The research used a mail questionnaire to solicit judgments about the likelihoods of two sets of listed variables. One list was composed of changes, occurring in many countries that, based on an extensive literature review, we judged could affect forest recreation management and use by the year 2005. The second list was the impacts on forest recreation that logically could be associated with each of the changes. For example, one identified change was "there will be an increase in the total population," with the impacts identified for that change being "continued increase in use of forest recreation opportunities" and "increases in uses to escape the stresses of population growth."

There were 29 different changes listed in the questionnaire, with up to 10 impacts listed for each change for a total of 86 impacts. Those changes and impacts were derived from several sources. They reflected changes in variables that have been empirically correlated with outdoor recreation participation in the past, such as age, income, availability of opportunity, etc. Furthermore, they reflected our reading of the literature on changes in society and what their impacts will be on leisure behavior (cf. Vol. 25, No. 4 of Trends, 1988). Godbey, particularly, has followed this literature during the past several years and has written a recent text on the subject (Godbey 1989) entitled The Future of Leisure Services: Thriving on Change. Lastly, the list of changes and impacts in the questionnaire included those that were suggested for this study by our professional associates.

People receiving the questionnaire were selected to represent different countries and different professional interests and vocations. Specifically, questionnaires were sent to 150 people in 25 countries who held teaching, research, or managerial positions in leisure services and primarily forest recreation. Many of these people were members of the Forest Landscape, Recreation, and Tourism Management Section (S6.01) of the International Union of Forestry Research Organizations. No attempt was made to achieve random sampling or to assure equal representation among different countries to which questionnaires were mailed. Our purpose was not to document what a representative sample of respondents thought about the likelihoods of the changes and impacts, but instead to solicit judgments about the likelihoods of those impacts by an informed group of professionals concerned with forest recreation. The results should not be interpreted as reflecting anything else.

Respondents were asked first to rate the likelihood that each listed change would occur in their country by the year 2005 and then rate the likelihood that each of the listed impacts (on forest recreation management or use) would occur during that same time period. The same likelihood response format was used to rate the changes and the impacts. The rating

Table 1.--Likelihood mean scores (and extreme (E) values), by country groups, for the changes and impacts listed in the questionnaire[a]

CHANGES (C) and Impacts (I)	$\bar{X}$s (and Es)			
	G1[b]	G2	G3	G4
C1. INCREASE IN TOTAL POPULATION.	3.2 (1,4)	1.4 (0,4)	1.1 (0,3)	2.2 (0,4)
I1. Continued increase in use.	2.9 (2,4)	2.4 (1,4)	1.4 (0,2)	2.6 (1,4)
I2. Growth in uses "to escape" the stresses of pop. growth.	2.4 (1,4)	1.8 (0,3)	0.8 (0,1)	1.8 (0,3)
C2. DECREASE IN RATE OF POPULATION GROWTH.	2.3 (0,4)	1.4 (0,3)	2.6 (1,4)	1.0 (0,2)
I1. Population-caused increases in use will diminish in importance.	1.8 (0,4)	1.5 (0,4)	2.6 (0,4)	1.7 (1,3)
C3. INCREASE IN AVERAGE AGE OF THE POPULATION.	3.7 (3,4)	2.7 (2,3)	3.0 (1,4)	1.8 (1,3)
I1. Continued decreases in rate of participation in the more physically demanding activities with aging of the groups.	2.2 (1,4)	1.9 (1,3)	1.4 (0,3)	1.6 (1,3)
I2. Higher proportion of the population participating in more "passive" recreation activities.	2.5 (1,4)	2.0 (0,4)	2.0 (1,3)	2.2 (1,3)
I3. Increased demands for services and facilities related to security and safety, comfort, and convenience.	2.8 (1,4)	2.1 (0,3)	2.3 (1,4)	1.2 (0,2)
C4. INCREASED AVERAGE HEALTH OF THE GENERAL POPULATION.	2.5 (1,4)	2.0 (0,3)	2.4 (1,3)	1.6 (0,3)
I1. Increased demands for the more physically demanding activities.	2.0 (1,4)	2.4 (1,3)	2.1 (1,3)	1.8 (1,4)
C5. INCREASE IN THE AVERAGE EDUCATION LEVEL OF THE GENERAL POPULATION.	2.5 (2,4)	2.1 (0,3)	2.4 (1,3)	2.0 (1,3)
I1. Increased demand for pre-trip and on-site information and educational services and facilities.	2.4 (1,4)	1.6 (0,3)	2.1 (1,3)	1.2 (0,3)
I2. Greater specialization in recreation behaviors, with users highly committed to those uses.	2.6 (1,4)	2.4 (2,3)	2.6 (1,4)	2.0 (1,3)
I3. Users highly informed about these specialized uses.	2.6 (1,4)	2.3 (2,3)	2.6 (1,4)	1.8 (1,3)
I4. More public involvement in the agency decision processes.	2.5 (1,4)	2.1 (1,3)	2.6 (1,3)	1.4 (0,3)
I5. Demands for higher quality opportunities.	2.8 (1,4)	2.0 (1,3)	2.9 (1,4)	1.8 (1,3)
C6. CHANGES IN THE ETHNIC MIX OF THE POPULATION; GROWTH IN THE PROPORTION OF TOTAL POPULATION REPRESENTED BY SUBCULTURES/MINORITIES.	3.3 (1,4)	1.7 (0,3)	2.0 (1,4)	0.8 (0,1)
I1. Changing preferences and demands for recreation opportunities will reflect increased prominence of minorities.	2.6 (1,4)	1.1 (0,3)	0.9 (0,1)	0.2 (0,1)
I2. Greater concern in recreation agencies about equity on-site.	2.5 (1,4)	1.6 (0,3)	0.9 (0,1)	0.5 (0,1)

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[a] The mean scores and extreme values were computed using the following coding of the likelihood response format on the questionnaire: Zero=0, Low=1, Moderate=2, High=3, and Certain=4. The extreme values (E) are the low (L) and high (H) responses displayed as (L,H).

[b] G1-G4 refer to groups of countries as follows, with responses per country in parentheses: G1=United States (16), Canada (2), New Zealand (5), and Australia (7); G2=Austria (2), West Germany (1), Netherlands (1), Israel (2), Italy (1); G3=Finland (3), Norway (2), Sweden (1), and Denmark (1); and G4=Czechoslovakia (1), Poland (1), Chile (1), Uruguay (1), and Brazil (1).

CHANGES (C) and Impacts (I)	$\bar{X}$s (and Es)			
	G1	G2	G3	G4
C6. (CONTINUED)				
I3. Greater concern within agencies about the off-site minorities that have been underserved and/or underrepresented in the past.	2.3 (1,4)	1.0 (0,2)	1.1 (0,2)	1.0 (0,3)
I4. Need for agencies and users to understand and integrate values and on-site behaviors of minorities with those of other users.	2.7 (1,4)	1.3 (0,3)	1.0 (0,2)	1.0 (0,3)
C7. CHANGES IN OLDER (ELDERLY) CITIZENS.				
C7(1) INCREASES IN HEALTH OF OF THE ELDERLY.	2.6 (1,4)	2.3 (2,3)	2.7 (1,4)	1.6 (1,3)
I1. Decreased rate of dropoff of participation in the more physically demanding activities than has occurred in the past.	2.1 (0,4)	1.7 (0,2)	2.4 (1,3)	1.4 (0,2)
I2. More absolute participation in the "more passive" activities.	2.5 (1,4)	2.1 (1,3)	1.9 (0,3)	2.2 (1,3)
I3. More volunteers.	2.5 (0,4)	2.3 (2,3)	1.6 (1,3)	2.5 (2,3)
C7(2) RELATIVELY WEALTHIER OLDER PEOPLE.	2.1 (1,4)	2.0 (1,3)	3.0 (1,4)	1.4 (0,3)
I1. More sophisticated tastes and preferences; demands for higher quality.	2.5 (1,4)	2.0 (1,3)	2.6 (1,3)	1.4 (1,3)
I2. More demands for information, both on-site and off-site.	2.5 (1,4)	2.0 (1,3)	2.4 (1,3)	1.8 (0,4)
I3. More international travel by the elderly.	2.7 (1,4)	2.6 (1,4)	3.1 (2,4)	1.4 (0,2)

CHANGES (C) and Impacts (I)	$\bar{X}$s (and Es)			
	G1	G2	G3	G4
C8. ADVANCES IN WOMEN'S RIGHTS, OPPORTUNITIES, AND POWER (ECONOMIC AND POLITICAL).	3.0 (2,4)	2.1 (1,3)	2.0 (0,3)	1.8 (1,3)
I1. More use of forest recreation by women.	2.0 (0,4)	1.4 (1,2)	1.1 (0,2)	1.4 (0,3)
I2. Shifts in demands for types of services and facilities, from dominance by men to accomodate interests and increased political and economic power of women.	2.0 (0,4)	1.3 (0,2)	1.6 (0,3)	0.8 (0,2)
C9. CHANGES IN FAMILY STRUCTURE				
C9(1). COUPLES WILL GET MARRIED AT AN AVERAGE OLDER AGE.	2.6 (1,4)	1.6 (1,2)	1.9 (0,3)	1.8 (1,3)
C9(2). COUPLES WILL HAVE FEWER TOTAL CHILDREN.	2.5 (0,4)	2.1 (1,3)	1.4 (0,3)	2.5 (1,4)
I1. Reduced need for children-related services and facilities.	1.4 (0,3)	1.7 (0,3)	0.7 (0,1)	0.5 (0,2)
C9(3). INCREASE IN NUMBER OF SINGLE-PARENT FAMILIES; INCREASE IN THE DIVORCE RATE.	2.7 (1,4)	2.3 (1,3)	2.3 (1,3)	2.7 (1,4)
I1. Increased need for non-family oriented services and facilities.	2.1 (1,4)	1.3 (0,3)	1.7 (1,2)	1.0 (0,2)
C10. DECENTRALIZATION OF POPULATION				
C10(1). TO SUBURBAN COMMUNITIES ON EDGE OF CITIES.	2.4 (1,4)	2.7 (1,4)	1.7 (1,2)	2.2 (2,3)
I1. Increased traffic congestion and difficulty in getting to sites, resulting in changed recreation travel patterns and use (e.g., fewer trips, timing of trips, etc.)	2.1 (0,4)	2.4 (1,4)	2.0 (0,3)	1.8 (1,3)

CHANGES (C) and Impacts (I)	$\bar{X}$s (and Es) G1	G2	G3	G4
C10(2). TO THE SMALLER COMMUNITIES.	1.9 (1,3)	1.9 (1,3)	1.3 (0,3)	1.8 (1,3)
I1. Increased use of near-by areas.	2.3 (0,4)	2.3 (2,3)	2.0 (1,3)	2.2 (1,3)
C10(3). TO COMMUNITIES WITH NATURAL AMENITIES.	2.4 (1,4)	2.2 (1,4)	1.3 (0,3)	1.4 (1,3)
I1. Increased use of areas with natural amenities.	2.5 (1,4)	2.7 (2,4)	2.3 (1,3)	1.4 (1,3)
C11. CHANGES IN LEISURE TIME.				
C11(1). DECREASE IN TOTAL HOURS OF LEISURE FOR THOSE IN THE WORK FORCE.	1.8 (0,3)	0.6 (0,1)	1.7 (0,3)	2.4 (1,3)
I1. Shorter average length of stay per trip.	2.3 (0,4)	0.7 (0,1)	1.5 (0,3)	1.8 (0,3)
I2. More trips, but nearer to home.	2.3 (1,4)	1.2 (0,2)	1.3 (0,3)	1.6 (0,3)
I3. Fewer multiple-destination trips.	2.2 (0,3)	1.3 (0,3)	1.2 (0,2)	2.6 (1,3)
C11(2). LONGER WORK WEEKS FOR THOSE IN THE LABOR FORCE.	1.4 (0,3)	0.5 (0,1)	1.3 (0,3)	1.6 (0,3)
I1. Shorter average length of stay per trip.	2.0 (0,4)	0.6 (0,1)	1.3 (0,3)	1.8 (0,3)
I2. More trips, but nearer to home.	2.2 (0,4)	1.0 (0,2)	1.2 (0,3)	1.8 (0,3)
I3. Fewer multiple-destination trips.	2.0 (0,3)	1.5 (0,3)	0.6 (0,1)	2.4 (0,3)
C11(3). FASTER PACE OF EVERYDAY LIFE.	2.6 (1,4)	2.4 (1,3)	2.4 (1,3)	2.0 (1,3)
I1. Shorter average length of stay per trip (i.e., will "rush at" everything).	2.0 (0,4)	1.4 (1,3)	1.6 (1,3)	1.8 (0,3)
I2. More impatient visitors (less willing to wait in lines, fill out forms, etc.)	2.5 (1,4)	2.4 (1,4)	2.1 (1,3)	2.2 (1,3)
I3. Increased demands for more efficient (and faster) operations.	2.7 (1,4)	2.5 (2,4)	2.1 (1,3)	2.0 (1,3)
I4. Increased demands for tranquil and stress-relieving opportunities.	2.8 (2,4)	2.4 (1,3)	2.7 (1,4)	2.4 (2,3)
C12. CHANGES IN PERSONAL DISPOSABLE INCOME OF THE MIDDLE CLASS.				
C12(1). LOWER RATE OF INCREASE (THAN IN THE PAST) IN PERSONAL DISPOSABLE INCOME.	2.9 (1,4)	2.1 (0,3)	2.1 (1,3)	2.8 (2,4)
I1. Shorter average length of stay per trip.	2.0 (1,4)	1.5 (0,3)	0.7 (0,1)	2.0 (0,3)
I2. More trips, but nearer to home.	2.1 (1,4)	2.0 (0,3)	0.9 (0,2)	1.4 (0,3)
I3. Fewer multiple-destination trips.	2.2 (1,3)	2.2 (0,3)	1.2 (0,2)	2.8 (2,3)
I4. More critical consumers.	2.7 (1,4)	2.3 (0,3)	2.3 (1,3)	2.2 (1,3)
C12(2). LOWER ABSOLUTE LEVEL OF PERSONAL DISPOSABLE INCOME.	2.3 (0,3)	1.2 (0,3)	1.6 (0,3)	2.0 (0,4)
I1. Shorter average length of stay per trip.	2.0 (1,4)	1.3 (0,2)	0.7 (0,1)	2.2 (1,3)
I2. Fewer trips.	2.2 (1,4)	1.4 (0,3)	0.9 (0,2)	2.2 (1,3)
I3. Fewer multiple-destination trips.	2.3 (1,3)	2.0 (0,3)	1.2 (0,3)	2.6 (1,3)
I4. More critical consumers.	2.7 (1,4)	2.0 (0,3)	2.0 (0,3)	2.0 (1,3)
C13. INCREASE IN RECREATION-RELATED INTERNATIONAL TRAVEL.	2.9 (2,4)	2.6 (1,3)	2.6 (1,4)	1.6 (0,3)
I1. Increased need to accomodate users from foreign countries.	2.8 (1,4)	2.4 (1,3)	2.6 (1,4)	1.8 (0,3)
I2. Increased conflicts between domestic and foreign users.	2.5 (1,4)	1.0 (0,2)	1.4 (0,2)	1.2 (0,3)

CHANGES (C) and Impacts (I)	$\bar{X}$s (and Es)			
	G1	G2	G3	G4
C14. CHANGES IN LIFESTYLES.				
C14(1). INCREASED COMMITMENT TO LIFESTYLE MANAGEMENT (BETTER NUTRITION, EXERCISE, STRESS MANAGEMENT, CONTROL OF SUBSTANCE ABUSE).	2.7 (2,4)	2.4 (1,3)	2.4 (1,3)	1.6 (1,3)
I1. Increased use of leisure for fitness (use of physically demanding activities).	2.4 (1,4)	2.4 (1,3)	2.4 (2,3)	2.6 (1,4)
I2. More committed users.	2.3 (1,4)	2.0 (1,3	2.4 (1,3)	2.5 (2,4)
I3. Greater involvement of users in the agency decision processes.	2.4 (1,4)	1.9 (0,3)	2.6 (2,3)	1.4 (0,3)
I4. Changes needed in eating facilities on-site (e.g., vegetarians do not need charcoal grilling irons).	1.6 (1,3)	0.9 (0,2)	1.8 (1,3)	0.8 (0,2)
C14(2). MORE HOLISTIC CONCEPT OF QUALITY OF LIFE, OR LIFE SATISFACTION.	2.4 (1,4)	1.8 (1,3)	2.0 (1,3)	0.8 (0,1)
I1. More use of forest recreation opportunities for spiritual growth.	2.1 (1,3)	1.7 (1,3)	1.6 (1,3)	1.0 (1,1)
I2. More integration of leisure activities with nonleisure ones	2.1 (1,3)	1.5 (1,2)	1.7 (1,3)	1.0 (0,2)
I3. Greater emphasis on learning and "discovery."	2.3 (2,4)	2.2 (1,3)	2.1 (1,3)	1.8 (1,3)
C15. DEVELOPMENT OF NEW AND BETTER RECREATION-RELATED EQUIPMENT.	3.0 (2,4)	2.0 (1,4)	2.4 (1,3)	2.2 (1,3)
I1. Demands for new services and facilities.	2.8 (2,4)	2.3 (2,3)	2.6 (1,4)	1.6 (1,2)
I2. Increased conflicts between user groups using specialized equipment.	2.9 (2,4)	1.6 (0,3)	2.3 (0,3)	2.0 (0,3)

CHANGES (C) and Impacts (I)	$\bar{X}$s (and Es)			
	G1	G2	G3	G4
C16. CONTINUED AND INCREASED CONCERN IN THE GENERAL POPULATION ABOUT ENVIRONMENTAL PROTECTION AND QUALITY.	3.2 (2,4)	2.9 (2,4)	3.0 (2,4)	2.8 (2,4)
I1. Increased amenity-related uses of natural areas.	2.7 (1,4)	2.6 (1,3)	2.4 (2,3)	1.8 (1,2)
I2. More informed public.	2.9 (2.4)	2.4 (2,3)	2.9 (2,4)	2.2 (1,3)
I3. More pressure for balanced multiple-use management that emphasizes the amenity uses more.	2.8 (2,4)	3.0 (2,4)	3.0 (2,4)	2.0 (1,3)
I4. More pressure to reduce the exploitative uses.	3.0 (2,4)	2.7 (0,4)	2.9 (2,3)	2.4 (1,4)
I5. More recycling, including paper products, which will reduce total domestic demand for timber products.	2.4 (1,4)	2.3 (1,4)	2.4 (1,4)	2.2 (1,4)
C17. INCREASED CONCERN ABOUT GLOBAL WARMING (THE "GREENHOUS EFFECT") AND THE "OZONE LAYER."	3.1 (2,4)	2.6 (2,3)	2.9 (2,4)	2.3 (1,4)
I1. Less participation in the "sun-intensive" activities, such as sunbathing.	2.1 (0,4)	1.9 (0,3)	1.0 (0,2)	2.0 (2,2)
I2. Greater agency attention to impacts of global warming (concern about coastal recreation resources, timber species composition, etc.).	2.6 (1,4)	2.4 (1,3)	2.1 (1,3)	1.5 (1,2)
I3. Reduced recreational use of streams, rivers, and lakes because of reduced flows and volumes of water.	1.2 (0,2)	1.1 (0,2)	0.6 (0,1)	1.3 (0,2)
I4. Reduced total participation in snow-dependent recreation activities.	1.5 (0,4)	0.8 (0,1)	1.0 (0,2)	0.3 (0,1)
I5. Increased number of recreationist-caused forest fires.	2.0 (1,3)	1.4 (0,3)	0.8 (0,1)	2.3 (2.3)
I6. Greater value placed on forest vegetation and cover.	2.8 (1,4)	2.3 (1,3)	2.1 (1,3)	2.3 (1,4)

CHANGES (C) and Impacts (I)	$\bar{X}$s (and Es)			
	G1	G2	G3	G4
C18. INCREASED RELATIVE SCARCITY OF NATIONAL PUBLIC FUNDS AND OTHER RESOURCES AS PRESSURES GROW FOR COMPETING USES.	3.0 (1,4)	1.9 (0,3)	2.0 (1,3)	2.0 (1,4)
I1. Reduced public funds allocated to forest recreation.	2.3 (1,4)	1.7 (0,3)	1.3 (1,2)	2.3 (2,3)
I2. Greater concern within agencies about the efficiency of their operations.	3.0 (1,4)	2.3 (1,3)	2.4 (1,3)	2.5 (2,3)
I3. More cooperative programs between private and public agencies.	3.0 (1,4)	1.4 (1,2)	2.0 (1,3)	2.3 (1,3)
I4. More use of volunteers.	2.8 (1,4)	1.7 (1,2)	1.7 (1,3)	1.5 (0,3)
I5. More conflicts between competing user groups.	2.9 (1,4)	2.1 (1,3)	2.6 (0,4)	1.3 (0,2)
I6. Need for better documentation of the benefits of forest recreation.	3.0 (1,4)	2.4 (1,3)	2.6 (1,3)	2.3 (1,3)
I7. Increased role of "marketing" and positive image-building by agencies, especially public ones.	3.0 (2,4)	2.6 (2,4)	2.6 (2,3)	2.0 (1,4)
I8. Greater reliance on user fees.	3.1 (2,4)	1.9 (0,3)	1.3 (0,3)	1.8 (1,3)
I9. Greater reliance on the private sector to offer opportunities.	3.1 (2,4)	2.4 (1,4)	2.0 (1,3)	2.5 (1,4)
I10. Shift in emphasis of public agencies toward revenue-generating opportunities, causing reduced attention to other types of opportunities such as those for remote hiking or camping.	2.4 (1,4)	1.9 (0,3)	1.9 (1,3)	1.8 (1,3)

CHANGES (C) and Impacts (I)	$\bar{X}$s (and Es)			
	G1	G2	G3	G4
C19. INCREASED PRICES FOR GASOLINE/PETROL (CAUSED BY FUEL TAXES OR BY LIMITED SUPPLY).	3.1 (2,4)	2.4 (2,3)	2.0 (0,3)	2.8 (2,4)
I1. Fewer trips.	2.1 (1,3)	1.3 (0,3)	1.1 (0,2)	2.2 (0,3)
I2. More trips of shorter time direction.	1.9 (0,4)	1.6 (0,3)	1.1 (0,3)	1.8 (0,3)
I3. More trips closer to home.	2.3 (1,4)	1.5 (0,2)	1.7 (0,3)	2.0 (0,3)
I4. Smaller recreation vehicles.	2.2 (1,4)	1.8 (0,4)	1.9 (0,3)	2.2 (2,3)
I5. Greater gap in income differences in users, with more lower income people being constrained from participating because of increased trip cost.	2.5 (1,4)	1.7 (0,3)	1.6 (0,3)	2.6 (1,4)
C20. DECENTRALIZATION OF FEDERAL/NATIONAL GOVERNMENTS AND GOVERNMENTAL AUTHORITIES.	2.3 (1,4)	0.7 (0,2)	2.0 (0,3)	2.4 (2,3)
I1. Higher burden on local units of government.	2.9 (1,4)	1.4 (0,2)	2.1 (0,3)	2.0 (0,3)
I2. Some services provided in the past by the federal/national government will not be provided at the same level of quantity or quality, and local units will not fill the gap.	2.8 (1,4)	1.0 (0,3)	1.7 (0,3)	1.8 (0,4)

scale consisted of Zero, Low, Moderate, High, and Certain likelihood, identified in our transmittal letter as indicating probabilities (i.e., likelihoods) of 0.0, 0.25, 0.50, 0.75, and 1.0, respectively. The respondents were instructed not to think about the absolute magnitude of each change and impact, but rather to focus their attention on the likelihood that at least a little change or impact would occur by the year 2005.

RESULTS

Of the 150 questionnaires mailed in early October 1989, 49 responses were received from 18 countries by mid-December, when those responses were analyzed. At least two factors explain the relatively low response rate. Turn-around time was short, and the questionnaire was rather long. However, we do not feel the low response rate is critical given that our primary interest was in getting informed opinions from professional people in different countries.

The responses are summarized in terms of mean scores and extreme values. Those statistics were computed by assigning numerical values to the same five response alternatives used to solicit perceived likelihoods both of the changes and impacts. Respectively, that scoring was 0, 1, 2, 3, and 4 for Zero, Low, Moderate, High, and Certain likelihood ratings. Thus, a mean score of 2.5 would indicate a Moderately-High likelihood (being halfway between Moderate and High), with a probability of 0.625. The extreme values represent the lowest (L) and highest (H) responses given for a designated change or item and are reported as (L,H). These extreme values are shown rather than standard deviations to show the absolute range in responses. Also, most of the sample sizes are rather small for meaningful interpretation of standard deviations.

We grouped the responding countries into the four groups shown in Table 1. That grouping was not based on any empirical clustering of the responses, which is planned for future analyses. Instead, we somewhat arbitrarily established four broad groups based on some type of similarity among countries within each group, while pursuing the goal of maintaining as large a sample as possible. The countries comprising each group, the total number of questionnaires received from each country (in parentheses), and the title given each group (underlined) are shown below.

Group 1 (G1). English-Speaking (N=30): United States (16), Australia (7), New Zealand (5), and Canada (2).

Group 2 (G2). European (N=7): Austria (2), Israel (2), Netherlands (1), West Germany (1), and Italy (1).

Group 3 (G3). Scandinavian (N=7): Finland (3), Norway (2), Denmark (1), and Sweden (1).

Group 4 (G4). Comparatively Less Economically Developed (N=5): Poland (1), Chile (1), Czechoslovakia (1), Uruguay (1), and Brazil (1).

One questionnaire from New Zealand combined the judgments of three experts, and the one from Denmark represented the combined judgments of two experts.

Most Likely Changes and Impacts by Country Groups

Each change and impact are shown in Table 1 as they were worded in the questionnaire. The reader is encouraged to study those lists of changes and impacts. To reduce the complexity of Table 1 to a more manageable scale, we decided to consider briefly only those changes and impacts that were rated as most likely to occur. To us "most likely" meant a higher likelihood than a 50-50 chance (i.e., a 2.0 mean score). We, therefore, somewhat arbitrarily decided "most likely" changes and impacts were those with $\bar{x} \geq 2.4$, which translates to a probability of 0.60 or higher.

We will review patterns of response by each of the four country groups and then summarize similar patterns among those groups. It should be emphasized that the informed judgments of a very small group of professionals are being discussed. We believe that this exercise can be instructive and useful in indicating probable trends and alerting forest managers to possible emerging impacts that they should be concerned about. However, it should be apparent that a more detailed study of trends in specific types of use within each country are needed to go beyond the summary speculations interpreted in the following discussion.

English-Speaking countries

All but seven (C2, C7(2), C10(2), C11(1), C11(2), C12(2), and C20) of the 29 changes were rated with a $\bar{x} \geq 2.4$ by the 30 respondents from the English-speaking countries. The two changes (C11(1) and C11(2) that were rated the lowest (means of 1.8 and 1.4, respectively) reflected the judgments (especially of respondents from New Zealand) that the amount of leisure time would increase, not decrease, for those in the labor force. On the whole, the ratings for the changes reflected judgments of high likelihoods of the changes by the year 2005, with eight changes (C1, C3, C6, C8, C15, C16, C18, and C19) receiving ratings of 3.0 or higher. Many of these ratings reflect a continuation of recent trends (cf. Godbey 1989).

A similar pattern was noted in the ratings of the 86 impacts, for which all but 38 were rated at $\bar{x} \geq 2.4$. However, only seven impacts (C16-I4 and I2, I3,I6,I7,I8, and I9 for C18) were rated at $\bar{x} \geq 3.0$, which were all impacts related to increased financial stringency at the federal/national level of government. Most of these prognosticated impacts tended to reflect continuation of present patterns in these countries. But they also indicated new patterns that officials responsible for management of forest recreation areas have not tended to address as much in the past as they probably will need to in the future. Included are the special demands of the elderly, members of minority subcultures, women, and single-parent families. Included, too, was the likelihood of need for more public/mass transportation to the areas visited, increased pressure for higher quality opportunities, and for more informational, educational, and interpretative services. Five changes (C11(1), C12(1), C11(2), C12(2), and C19) each listed impacts that more future trips would be nearer to home and of shorter time duration. Both of these two impacts had moderately strong ($\bar{x}$ of 2.0-2.3) ratings for all five of the changes. Since the questionnaire was designed before the recent dramatic changes took place in many Eastern European countries, we did not include a change related to reduced defense spending. But several written-in comments from respondents from the English-Speaking countries explicitly suggested the likelihood was high that the so-called "peace-dividends" will positively affect not only environmental protection but also management and use of publicly administered forest recreation areas.

Last, it should be noted that despite these overall high ratings, there was considerable variance between these 30 respondents, with the extreme values being either (0,4) or (1,4) for 79 of the total of 115 changes and impacts.

European countries

Only eight of the 29 changes (C3, C10(1), C11(3), C13, C14(1), C16, C17, and C19) were rated at $\bar{x} \geq 2.4$ by the seven respondents from the European countries, with C16 having the highest rating of 2.9 (For the English-Speaking countries, 22 of the changes were rated at $X \geq 2.4$.) For the 86 impacts, only 19 were rated with $\bar{x} \geq 2.4$, with seven of these being for C16 and C18 (concerns about environmental protection and financial stringency, respectively). We detected no particular pattern to these responses other than that the seven respondents were quite discriminating and the variance was generally lower than for respondents from the English-Speaking countries, which can be explained in part by the much smaller sample size for the European countries.

Some "predictions" that should be of particular interest to forest managers in these countries are: Increased visits by foreign users; More demands for higher quality opportunities by better educated and more highly specialized users; Continued impacts both from urbanization and decentralization; Demands for more informational and educational services; and Continued public concern for more balanced multiple-use management that appropriately recognizes and provides opportunities for the amenity uses.

Scandinavian countries

The seven responses received from the four Scandinavian countries were similar to those from the European countries, both in the general magnitudes of the ratings and in those changes and impacts that were rated with $\bar{x} \geq 2.4$ Of the 29 changes, 12 (C2, C3, C4, C5, C7(1), C7(2), C11(3), C13, C14(1), C15, C16, and C17) were rated with $\bar{x} \geq 2.4$, with C3, C7(2), and C16 each getting the same highest mean rating of 3.0. Only 24 of the 86 impacts were judged to equal or exceed a probability of occurrence of 0.60 or higher, with only two of these means (3.1 for C7(2)-I3 and 3.0 for C16-I3) reflecting an average rating of High. As for the European countries, a large number (10) of these impacts were for C16 and C18. The implications of special concern to forest managers are the same as for the responses from the European countries except that less need for additional informational and educational services was registered, while more impact of international tourism was envisioned.

Comparatively less economically developed countries

This country grouping is problematic in two regards. We are not totally comfortable with the title, but it is the best we could think of; an alternative designation of "Other" seemed useless. Also, this group of countries reflects greater cultural variation than any of the other three groups, which makes any generalization more hazardous.

The five respondents in this group registered judgments of likelihoods that contrast sharply with those of the other three country groups. Only seven of the 29 changes (C9(2), C9(3), C11(1), C12(1), C16, C19 and C20) were rated with $\bar{x} \geq 2.4$, with these means being 2.5, 2.7, 2.4, 2.8, 2.8, 2.8, and 2.4, respectively. Of the 86 impacts, only 12 were rated with $\bar{x} \geq 2.4$. Furthermore, only 39 impacts were rated equal to or higher than 2.0, (i.e., equal to or greater than a 0.50 probability). There is indication that many existing constraints on participation will continue. For example, three of the seven changes given a 0.60 or higher probability of occurrence were: decrease in total hours of leisure (C11(1)), lower rate of increase in personal disposable income (C12(1)), and increased cost of petrol (C19). The major implications to forest managers were: There will be continued increases in use (but apparently not at a rapid rate); There will be increased pressure to reduce the exploitative uses of forest lands; and Public funds for forest recreation will continue to be tight.

Similar responses by country groups

Similarities across the four country groups can best be understood by examining all changes and impacts with $\bar{x} \geq 2.0$ (i.e., moderate likelihood--or 0.50 probability--or higher). All four country groups rated the following changes with $\bar{x} \geq 2.0$:

1. The average education of the general population will increase (C5).
2. There will be an increase in the number of single-parent families (C9(3)).
3. Concerns about environmental protection will increase (C16).
4. New and better recreation-related equipment will continue to be developed (C15).
5. The pace of everyday life will become faster (C11(3)).
6. Concerns about global warming will increase (C17).
7. There will be a lower rate of increase in personal disposable income than in the past (C12(1)).

8. The price of petrol will continue to increase (C19).

The first five of these eight "worldwide" likely changes will tend to expand and add variety to forest recreation uses. The last three will likely serve as constraints. All eight will either extend current, or create new, challenges and responsibilities for forest managers. Specifically significant is the agreement across these four country groups that the users will be better educated and more informed, more committed and more highly specialized, more critical, and less patient. Those users will demand both higher quality and more efficient operations, demand more opportunities for physical fitness and for learning and discovery, and exert pressures for "balanced" multiple-use management of forests that gives appropriate recognition to the amenity-related uses. Also, there was unanimity that there will be greater reliance placed on privately owned forest lands and on lower units of government to provide forest recreation opportunities than in the past.

When one drops the Comparatively Less Economically Developed group of countries (G4), the above list of eight changes with X ≥ 2.0 increases by the addition of the following seven changes for each of the three remaining country groups.

1. Increase in average age of the population (C3).
2. Increase in average health of the population (C4).
3. Increase in average health of the elderly (C7(1)).
4. The elderly will be relatively wealthier as a class (C7(2)).
5. Increase in women's "rights" and power (C8).
6. Increased commitment to "life-style management" (C14(1)).
7. Increase in international travel (C13).

Interestingly but not surprisingly, six of these added changes that show unanimity without G4 all define demographic (Nos. 1-4) or "value-oriented" (Nos. 5&6) changes. Table 1 shows that the likely impacts on forest recreation management and use implied by these changes are varied. Of particular interest within these three country groups should be the probable increase in requirements of managers to consider: the needs and preferences of particular user groups such as the elderly, women, single-parent families, and foreign tourists--both to facilitate the provision of the wide spectrum of high quality opportunities that will be demanded by more critical users and to reduce expected increased conflicts between user groups; increasing demands for both on- and off-site informational and educational services; and growing public involvement in the agency's allocation and managerial decision processes. For these three groups of countries, these challenges are added to the list of those eight changes previously mentioned. When summed, the considerable challenges to forest managers in these three groups of countries are apparent.

SUMMARY AND CONCLUSIONS

Table 1 shows that 29 changes and 86 impacts were identified by the authors. We believe that this list itself is a useful "mental check list" for forest recreation professionals to ponder as they move into the 21st Century. We also received 49 responses from 18 countries, each of which clearly reflected diligence and considerable deliberation--based on few spaces left blank, the profusion of comments written-in to qualify responses made, and the many and sometimes lengthy letters that accompanied the returned questionnaires. Table 1 shows the respondents provided much more information than could be interpreted in this article. That table displays many patterns that are quite similar among the four country groups and other prognoses that differ remarkably between those groups.

Although we utilized a very small sample, given the number of countries involved in our study, ths results suggest strongly that the forest recreation manager of the near future will have to accommodate demands and changes not experienced in the past. Some of the changes and impacts clearly represent already identified trends in some countries. For example, recent trends in forest recreation use in the U.S. have been toward more frequent trips of shorter distance and of less time duration. Other likely trends lack this precedence.

Our conclusion is that forest managers will be challenged to manage more efficiently, more from a pluralistic perspective, and more for the leisure use of forests. Doing so will likely require experimentation, perhaps cutting back on quantity of service to increase quality, and increasing communication with the user and nonuser publics.

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LANDSCAPE EXPERIENCE IN POPLAR FORESTS

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SUMMARY

New multiple use forests of about 30.000 ha. are planned for the most urbanised, western parts of the Netherlands. Because of soil conditions, poplar, willow and alder might dominate, unlike existing forests, dominated by conifers. Uncertainty about recreational attraction of such new forests prompted research into the perception of soft-wood forests.

This paper reports a pilot study for testing methods of measuring experience and valuation, and a main research by interviewing visitors at selected forest sites with tree species similar to new forests. The results indicate, that experience value may be quite high under certain conditions. Recommendations are presented that may be useful to realise recreational potencies.

Keywords: new forests, recreation forest, attraction of poplar forests.

INTRODUCTION

The Dutch government recently formulated a policy to expand the forest area in the Netherlands, now being about 300.000 ha. i.e. about 8% of the total land area. The government plans to develop about 30.000 ha. of new forests.

Motives for this afforestation plan are:

- stimulation of wood production in order to become less dependent on wood imports;
- providing more recreation opportunities, especially near urban areas;
- development of new opportunities for natural areas;
- alternative use for submarginal agricultural areas.

In the meantime, several sites in the Netherlands are being afforested. Priority has been given to submarginal agricultural land in the highly urbanised western part of the Netherlands. Because of soil conditions there, mainly clay and peat, broadleaf species dominate; specially quickly growing species like poplar, willow and alder, but oaks and beeches are planted as well.

The question arose what attraction such forests will have for recreation, and how recreationists will perceive them. This question is very relevant, because forest recreation is the most popular type of outdoor recreation in the Netherlands. Dutch households visit forests with an average of about fourteen times a year with a wide spectrum of pursuits. Walking and cycling are specially popular.

Measurement of attraction and perception of forests is rather difficult, since they seem to be strongly related to rather vague feelings of comfort and discomfort. Visitors in forests are not aware of the forest characteristics, and certainly not continuously. Adequate planning of environments needs information on effects of specific aspects, but environments are mainly perceived as total images.

Another complication for the new forests is, that many Dutchmen hardly know the type of forest involved. It is difficult to interview people about unknown situations. Unlike the new forests to be expected in the western part of the country, existing forests in the others parts are dominated by conifers on dry and sandy soils.

Because of this, it has been decided to split up the research design in two parts:

1. Pilot study for testing the methods for measuring the experience and valuation of forest;
2. Main research by interviewing visitors at selected forest sites with tree species similar to new forests;

In order to create a frame of reference at the start of the research, sites were selected where poplar species prevail.

PILOT STUDY

One forest site with poplars on wet sands has been selected for pretesting.

Four ways of presenting forest sites have been tested in order to select the most adequate method for experience research:

1. Visiting the site with a guided walk in small groups (maximum: 5 persons);
2. Showing parts of the walk through the site with a video show;
3. Showing typical images of the site with a slide serial;
4. Showing specific aspects of the site with several series of photographs.

Two research groups were formed, selecting persons more or less arbitrarily. The test group had a somewhat higher level of forest visiting experience than the control group.

The test group participated in the guided walk three times, and responded a few weeks later to the video show, the slide serial, and the series of photographs. The control group did not visit the site itself, but responded only to the visual media.

Adequacy

Members of test groups were asked which of the visual media represents the site best in their opinion, compared with the guided walk. The control group could not compare the visual media with the site itself, but was asked which of the media seems best to represent an area like the test site. Scores form zero to ten were given after short group discussions, and reflect many general remarks given on that occasion. Adequacy of photos could not fully be measured in the test group because of technical circumstances, but the general remarks suggest a score close to the score for slides.

Table 1: Adequacy

	test group	control group
walk	9,1	-,-
video	3,5	5,8
slides	7,2	7,9
photos	-,-	6,5

As expected, the guided walk was valued as best by the test group. The video presented was considered to be much less adequate. Negative aspects were:

- the screen is too small;
- impressions of depth disappear;
- images change too fast, resulting in little cohesion;
- the image of the forest area as a whole disappears;
- density and height of vegetation is difficult to ascertain;

Such negative aspects were also mentioned by members of the control group, when comparing the video show to slides and photographs. The score was not as low as in the test group, however, which may be ascribed to the difference in opportunity to compare the video with the guided walk.

Both groups prefer the slides serial among the visual media, but the series of photographs did pretty well.

Semantic differential

Members of the test group were asked to describe their experience of the site through a semantic differential, immediately after their second walk. Members of the control group were also asked to describe their experience of the site in the same way, immediately after the presentation of each of the visual media.

Table 2. Profile of semantic differential

low score = 0	test group	---- control group -----			high score = 7
	walk	video	slides	photos	
restless	6.1	6.6	5.4	4.6	calm
gruesome	5.3	6.2	5.8	5.4	reliable
heavy	5.1	5.8	6.0	5.4	light
busy	5.5	6.3	4.2	4.6	quiet
unfriendly	4.9	5.2	5.6	5.0	friendly
repulsive	5.1	4.5	5.0	5.4	inviting
uncomfortable	4.9	5.2	5.2	5.0	comfortable
lost	4.8	4.7	4.8	5.4	safe
monotonous	5.5	3.7	4.5	4.6	varied
ugly	5.1	4.3	4.8	4.6	beautiful
oppressive	4.8	4.8	4.8	4.8	relieving
formal	5.3	4.3	3.4	4.8	informal
cheerless	4.9	4.0	4.8	5.0	cosy
boring	5.2	4.2	4.6	3.8	fascinating
dense	3.9	5.5	5.4	4.2	open
disorderly	3.3	5.5	4.4	3.8	orderly
ordinary	4.2	3.3	3.2	3.4	extraordinary
artificial	3.7	2.8	3.4	4.4	natural
small	2.9	3.2	3.8	4.0	large
young	2.9	2.2	2.6	3.0	old

In general there were only limited differences between the test group after the guided walk, and the control group after each of the visual media. The conclusion might be, that visual presentation has little influence on the responses. If, however, one looks at the various scales of the control group on the semantic differential, it appears that the valuation based upon the series of photographs shows the best similarity with the valuation by the test group based on the guided walk. Especially the somewhat artificial and orderly character of the forest scored high, both after the guided walk and after the series of photographs.

By contrast, respondents gave a roughly similar profile after the video show and slide serial, but on the basis of different considerations. The video show resulted much more in an image of a very quiet forest. The opinions based on the slide serial differed in respect to the friendliness of the forest.

Selecting the presentation method

The decision which representation method to use, was also influenced by practical arguments. Thus, it is inconvenient to organise guided walks for large numbers of people. Especially when such walks would be held on the same day, crowding could play a heavy role. For large-scale research, one of the visual media must be selected.

For video and slides, a suitable room should be available, where people must purposely take a seat. There are serious risks of a larger non-response if people must wait for restarting the show.

A presentation of photographs hardly has such drawbacks, and has more opportunities to represent various aspects separately. Moreover, individuals have the opportunity to look at them, and respond to questions at their own speed.

The practical arguments only add to the more important methodological advantages, especially:

- the rather positive score as an adequate instrument;
- the similarity with the scores of the semantic differential after the guided walk.

Because of these reasons, the photos were eventually selected as the most adequate method of representation. The series are presented later in this paper.

MAIN RESEARCH

It was considered that testing the series of photographs at home or in a laboratory would enable to select respondents representative to the Dutch population, including those with very few visits to forests. Those advantages were expected to be overthrown, however, by the advantages of interviewing in an environment of the same kind as the site to be evaluated. The choice for selecting visitors in existing forests offered especially the opportunity to let that forest be compared with the test site, represented by the pictures.

The main research took place in five existing forests with some similarity to forest types to be expected in afforestation projects in the western part of the Netherlands. Various sites should be selected in order to generalise the results, and to cope with secondary differences in landscape characteristics (e.g. age of the forest stands).

For the selection of research sites, the following criteria were used:

1 forest areas should be dominated by soft-wood species, i.e. poplar, willow, alder etc.;
2 the site should have a moderately good level of recreational equipment;
3 the site should be in the western part of the country or not too far from there;
4 the forest should have an area of more then 50 ha., or being part of a larger forest area of that size;
5 the selected sites together should represent all development stages of poplar forests.

A total of only 15 forest areas appeared to fulfil these criteria roughly, from which 5 research areas were chosen.

RESULTS

General appreciation

In several ways respondents' opinions about the test site and the visited areas have been measured.

One of those methods was the semantic differential as in the pilot study, presenting some 20 bi-polar adverbs and scales on which respondents should indicate in what degree one of the polar concepts applies to the test site. Scales to be regarded positive scores are **fascinating**, **varied**, **extraordinary** and **informal**. Relatively negative meanings are shown by **uncomfortable**, **heavy**, **oppressive** and **disorderly**. Other adverbs were difficult to interpret as positive or negative.

For the majority of recreationists, the photographed forest makes a **reliable** and **calm** impression; they find it a **beautiful**, **fascinating**, **extraordinary** and **varied** forest. While the concept **informal** is considered to apply, the forest evokes an **oppressive** atmosphere as well. This is possibly associated with the densely wooded character of the area, experienced as **heavy** and **oppressive**.

On the other hand there is neither much appreciation for a very **open** and **artificial** landscape that goes along with poplar forest as well. At last, it is striking that most people find the forest quite **cheerless**, which may be explained by the absence of people on the pictures.

Table 3. Profile of semantic differential

low score = 0	pilot study mean	main research mean	main research standard deviation	high score = 7
restless	4.6	4.6	1.52	calm
gruesome	5.4	4.8	1.35	reliable
heavy	5.4	2.2	1.24	light
busy	4.6	4.8	1.83	quiet
unfriendly	5.0	3.9	1.25	friendly
repulsive	5.4	2.7	1.30	inviting
uncomfortable	5.0	2.8	1.97	comfortable
lost	5.4	3.2	1.58	safe
monotonous	4.6	5.2	1.73	varied
ugly	4.6	4.4	1.48	beautiful
oppressive	4.8	2.4	1.52	relieving
formal	4.8	5.0	1.77	informal
cheerless	5.0	1.3	1.29	cosy
boring	3.8	5.0	1.48	fascinating
dense	4.2	3.9	1.59	open
disorderly	3.8	2.1	1.51	orderly
ordinary	3.4	5.4	1.44	extraordinary
artificial	4.4	2.9	1.52	natural
small	4.0	2.6	1.47	large
young	3.0	3.0	1.47	old

It should be stated, that the interpretation of the semantic differential partly leads to contradictory results. Adverbs like **heavy** and **oppressive** are opposed to **familiar** and **informal**. The series of pictures must contain such contradictory aspects, which is hardly to ascertain, however.

Another possibility might be that respondents are hardly able to manage bi-polar adverbs as mentioned; they may be too vague for forests and cause a desultory scoring. A further analysis of the scores shows, that the standard variation of most scales is restricted, so there is a rather high degree of agreement. Exceptions are: busy-quiet, formal-informal, and pleasant-unpleasant.

Ranking within series of photographs

There were four series of photographs: path structure, forest type, undergrowth and landscape. Each series contained six pictures, shown on the following pages. Respondents were asked to rank the six pictures within each series. The best picture scored 6 points, the picture selected last scored 1 point.

Table 4. Mean ranking scores of photographs

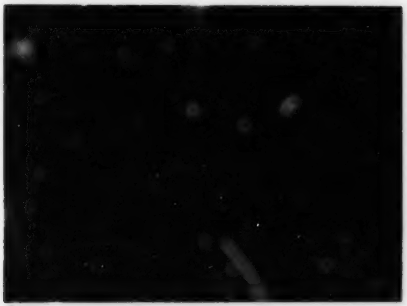
picture	path structure	forest type	under- growth	land- scape
A	1.7	2.4	1.9	2.2
B	3.2	3.7	3.1	3.9
C	4.1	3.6	4.4	2.8
D	3.8	3.3	4.0	4.3
E	3.8	3.8	3.8	4.0
F	4.6	4.3	4.0	3.9

In general, the results confirm that forest visitors appreciate areas with much variety, referring to species, age, path, as well as to forest fringe. Variety emerge as an important positive experiential value: open and dense landscape, density of vegetation, stratification of shrubs and trees. Variety in the landscape structure is expressed in the presence of winding paths, fringes of forest stands with different species or with agricultural land.

People appreciate undergrowth if it contains variety in height and composition, and if it does not interfere with viewing through the wood. A varied shrub layer, transparent and thus not interfering viewing through, is very much appreciated by recreationists. Results of the series of photographs showing several forest types indicate that, confirmed by the negative score for the semantic scale at heavy, dense woods. It is important too, that undergrowth prevent a view at bare trunks, giving a wood a less cultivated character.

Paths with a twisted course are better appreciated than wide lanes with side trees. Recreationists have an outspoken preference for narrow, winding paths, where the vegetation grows up to the edge. Such paths often give a 'natural' impression, better than wide lanes, and this will contribute to this positive appreciation.

PATH STRUCTURE


A

B

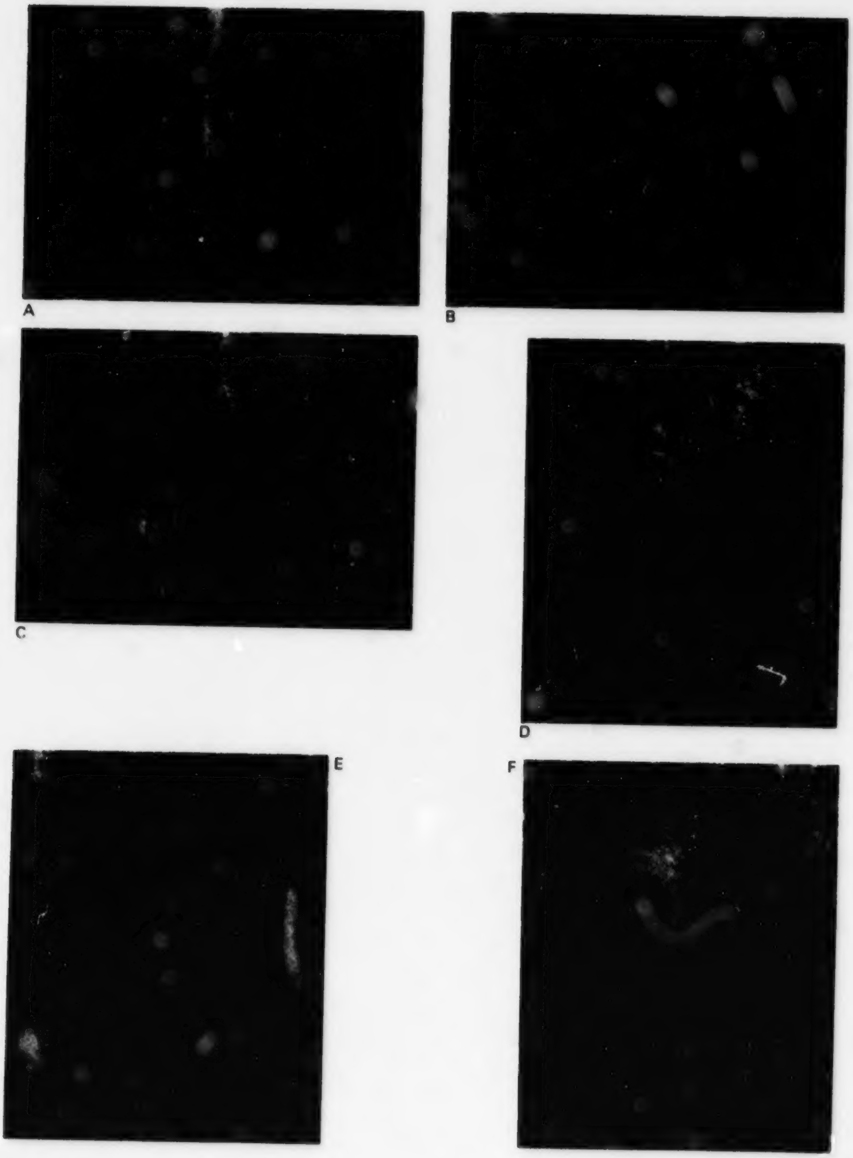
C

D

E

F

FORESTTYPE



A

B

C

D

E

F

UNDERGROWTH

A

B

C

D

E

F

LANDSCAPE

A

B

C

D

E

F

CONCLUSIONS

When developing new forest areas, aspects like 'naturalness', 'variety' should be expressed in the design. 'Natural' means that a strongly cultivated impression of the woodlands should be avoided.

A few other elements emerge from this experience research that are positively valued. If one wants to link up with such experience values, attention should be paid to the items mentioned hereafter:

- the structure of the forest area should be characterised by a combination of small-scaled parcels of woodlands, meadows and fields;

- the use of different broadleaf tree species, preferably within a stand too;

- creation of potencies for the development of a varied undergrowth;

- variation of density and height of the undergrowth;

- care of views through stands by keeping the undergrowth below eye level, or keeping sufficient distance between the trunks;

- construction of narrow paths with twisting course.

It is important to realise that striving for maximum variety in the composition of woods, paths, undergrowth and landscape may also produce an unwanted effect. In the first place, variation in the use of certain species can make a cultivated impression. The vegetation should rather be linked up to the natural variety in an area (soil conditions, height and humidity).

Moreover, repetition of variation can be dull in turn. Thus, a forest with twisting paths only, or an everlasting variety of vegetation has only little variety on a higher geographical level. The thing is to make clear that limits should be drawn to the extent and scale of variation used in a design.

The same aims should apply in principle to the management of existing forests as to the development of new ones. If one wants to go along with recreationists' experience values, one should try to maintain variation in variety, and thus avoid the impression of artificiality in the forest. The following recommendations can be formulated:

- Create variation in density and light by means of thinning, thus making vistas and promoting chances of spontaneous development of undergrowth.
- Introduce grazing (e.g. semi-wild cows) to differentiate composition and location of tree, shrubs and herbs. This form is only suited for large forest areas.
- Strive for variety of stands and vegetation at reafforestations.
- Plant shrubs in wide grassy roadsides.

It appears in all, that a forest suitable for recreation with a high experience value has a potency of a very positive effect on nature values in those new forests.

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LANDSCAPE MANAGERS' AND POLITICIANS' PERCEPTION OF THE FOREST AND LANDSCAPE PREFERENCES OF THE POPULATION

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SUMMARY

Results based on two different methods of investigation of landscape managers', students' and politicians' perception of the forest and landscape preferences of the general population are given. Results for different segments (in term of education and occupation) of the expert groups are also given. The results are grouped according to the character of the landscape management actions which might influence the quality of an outdoor experience. It is concluded that in about two thirds of the issues under investigation, similarities exist between the experts' perceptions and the preferences of the population. Misperceptions are found in connection with recreation facilities and more unmanaged forests with dead trees and gnarled stems. Different groups of experts also differ in their perception of population preferences.

Keywords: Forest preferences, experts' perception, SBE, interviewing.

INTRODUCTION

In Danish forest recreation planning up till 1988, there has been a lack of knowledge of what the visitors want from the area in question.

So landscape managers have at least in part been forced to turn to their own preferences or rely on conjectural answers to questions like: How do visitors feel about different management alternatives? What types of recreation facilities do thay want to find in the forest? - And to what extent? Sometimes the answers to these questions are influenced by manifestions from the more articulate interest groups. One can ask the obvious question:
"How do these 'expert guesses' agree with what the population - the visitors - actually prefer?".

This paper gives the results of a study of landscape managers', students' and politicians' perception of the forest and landscape preferences of the Danish population. The concept "managers" has to be understood broadly in this context. The group consists both of people working in the field (e.g. forest owners and persons employed by a forest district), people from the central and local administration who mainly work with planning and nature conservation. But persons in education and research are also classified as managers. The manager group has therefore been divided into different segments, to obtain more detailed and accurate information.

Regarding the group of students, they were mainly students who attended the lectures in the course "Landscape and Nature Management" at The Royal Veterinary and Agricultural University of Copenhagen, - mostly forestry, landscape architecture and agriculture (agronomy) students.

We also got a group of politicians to express what they presume to be the preferences of the Danish population. The politicians were all members of the Danish Parliament (and members of the Environmental and Planning Committee of the Parliament). These viewpoints are interesting as this particular group of politicians is influential in deciding priorities in the environmental sector - including forest recreation.

METHODS OF DATA COLLECTION

The forest and landscape preferences of the Danish population are described in part four of the Project "Forest and Folk" (*Koch* and *Jensen* 1988).

In this paper the landscape managers', students' and politicians' perception of the preferences of the visitors are compared with the results found in that national investigation. The perception results presented here are obtained by having parts of the questionnaire material (photos or slides) from the national investigation assessed by the different "expert groups".

The left side of Figure 1 gives an overview of the national investigations carried out to estimate the preferences of the Danish population (*Koch* and *Jensen* 1988).

The following notes explain the schematic overview of the *perception investigations* presented in this paper (the right side of Figure 1):

1) Method of data collection: Data were collected in connection with different arrangements (e.g. annual meetings, conferences, courses etc.), where it was possible to contact relatively large groups of managers, students or politicians. Altogether, 19 collections of data were made during the ten-year period. The number of respondents at each arrangement varied from 20 to 227.

2) Selection of the topics/(objects) investigated: In the selection of the topics that respondents had to assess, three criteria were found important: (1) whether the topic might influence the forest visitor's experience, (2) whether it has a certain economic importance, and/or (3) whether the feature can be regulated by the landscape manager.

3) The Experimental Method: Here the topics investigated were presented to the respondents in the form of *black and white slides*.
The Experimental Method involves the use of pairs of photos (slides) that are identical except for one factor, namely the factor/topic to be assessed. In taking the photos, great importance was attached to making the photos in the same pair appear as alike as possible - with the exception of the

Preference estimations made at Project »Forest and Folk«			
Publication	**PART IV** (*Koch* and *Jensen* 1988)		**THIS PAPER**
Aim	To investigate the forest and landscape preferences of the population and of different segments of the population.		To investigate the perception by expert groups of the preferences of the population.
Sub-investigations	**The Experimental Method** (postal questionnaires)	**The SBe Method** (personal interviewing)	**Personal Interviewing of Selected Expert Groups**
Method of Data Collection	*Questionnaire survey* of 2.826 individuals representing the population (16-77 years).	*Personal interviewing* of 216 individuals representing the population (16-77 years) at their home.	*Personal interviewing* of selected groups of landscape managers, students and politicians.
Period of Data Collection	April 1977– April 1978	November 1977– November 1978	1979–1989
Presentation Form of the Landscape (the Stimuli)	52 *black and white photos*, which pair- or groupwise are alike except for one factor, and 100 *verbal stimuli*.	160 *colour slides* randomly sampled from 4 types of landscape: broadleaved forest, coniferous forest, the countryside, and facilities for forest recreation. *Promotion* of broadleaved/coniferous forest is tested as verbal stimuli.	A selection of the same *photos* or *slides* as used in the Experimental or in the SBe Method in part IV.
Response Formats	*Ranking* of 7 randomly sampled photos and 7 randomly sampled verbal stimuli.	*Ratings* of 80 summer or winter slides. Each type of landscape is represented by 20 summer and 20 winter slides.	*Closed response format* when assessing pairwise the photos from the Experimental Method. *Ratings* when assessing the SBe-slides.
Response-percentage	89.4 %	87.9 %	Varying from 85 % to 100 %
Results regarding	*The preferences of different segments of the population* for the 52 black and white photos and the 100 verbal stimuli, and *the regional and seasonal variation* in these preferences.	*Elaborating and controlling the Experimental Method* regarding the preferences for the 4 types of landscape, and one test of *the effect of promotion on the preferences for broadleaved/coniferous forest.*	*The landscape managers', students' and politicians' perception of the preferences of the population.* Including results from *different expert groups.*

Figure 1: Overview of some of the forest and landscape preference investigations carried out at Project "Forest and Folk".

factor/topic under assessment, cf. Figure 2 for an example of a pair of photos.
The interviewees were shown 13 pairs of black and white slides. Each respondent had to choose between the left or right slide on the screen - or indicate "indifference" on the questionnaire.
The assessing criterion was:
"*Which woodland environment do you think the forest visitors prefer ?*".

The *advantages* of the Experimental Method are the experimental lay-out of the presentation forms used for the topics under investigation, and the method's ability to cover many topics. The *disadvantages* of the Experimental Method are that each topic is only represented by a few black and white photos/slides, and that these have been picked subjectively.
The *analyses of the data* gained using the Experimental Method were carried out by simple cross-tabulations and chi-square tests.

4) The SBE Method - "The Scenic Beauty Estimation Method" - was developed by *Daniel* and *Boster* (1976), and modified for the Danish investigations by *Koch* (1977). The *modifications* consist of using a different method of analysing the data (see below), using a random sample of the Danish population as respondents in the investigation of the preferences of the population, and using colour slides of four types of landscape randomly sampled from all over Denmark.
The aims of using the SBE Method were to elaborate and control the results of the Experimental Method as regards preferences for four types of landscape: *broadleaved forest, coniferous forest, the countryside* and *facilities* for forest recreation. The *advantages* of the SBE Method are the use of colour slides chosen objectively (randomly sampled), and the use of many slides to represent each topic under investigation. This way the SBE Method counteracts the disadvantages of the Experimental Method. A *disadvantage* of the SBE Method is that it is a resource-demanding method.
In the SBE Method each respondent assessed 40 colour slides, half the number used in the national survey of the preferences of the population (and only winter slides were shown to the experts).
Each of the four types of landscape - broadleaved forest, coniferous forest, the countryside and facilities for forest recreation - were then represented by 10 colour slides taken in winter. The places where the colour slides were taken were chosen objectively/(randomly sampled) so the slides would represent the 4 types of landscape in Denmark at the time when the slides were taken (1977).
The colour slides were shown in random order on the screen, and the instructions on the awarding of points (1 to 10 points) to the slides, on the questionnaire, were given in a text slide, which opened the show of slides. The rating criterion was:
"*What do you think the visitors prefer ?*".
The *analyses of the data* gained using the SBE Method were carried out by calculating the mean rating given to each of the four types of landscape by each respondent, and then comparing two types of landscape by analysing the respondents' differences between the mean rating of the two types of landscape. A detailed description of the method of analysing the data using the modified SBE Method is given in *Koch* and *Jensen* (1988) - and compared to the method proposed by *Daniel* and *Boster* (1976).

5) The response-percentage for the investigations was between 85 and 100% (eight of the 19 collections had a response-percentage of 100).

RESULTS

Results of the experts' perception of the forest and landscape preferences of the population are given for the following issues:

Nature in general,
The silvicultural system,
The choice of tree species,
Regeneration, formation and tending of stands,
Recreation facilities and
Influences related to recreational use.

Nature in General

The countryside

On average the population prefer the forest to the countryside in wintertime. That result applies whether the countryside is compared with broadleaved forest, coniferous forest or forest with recreation facilities. This is also the perception of the experts, cf. Table 1. Only two groups of experts do not have the perception that the population prefer the three types of forest to the countryside: the agriculture and forestry students, both of whom place the countryside ahead of forest with recreation facilities. Table 1 also shows that the landscape architects have the highest perception that the population prefer the forest to the countryside.

Grassland (in the forest)

This topic is investigated with slide pair no.1 in Table 2. All three groups of experts believe that the general population prefer an old beech forest to grassland in forest - which is actually not the case. Especially the students (and in particular the landscape architecture and agriculture students) are wrong in their perception of this topic. Three segments of the manager group have the correct perception of the preference of the population, viz. the masters of forestry, persons employed by a forest district and persons in nature conservation/planning.

Bog

A majority of the experts have the correct perception of whether the population prefer a naturally regrowing bog to a bog planted with ash (Table 2, slide pair no. 6). The assessment by all the different segments of the student group points in the right direction. Groups of managers where the majority are wrong, having the perception that the population prefer a bog planted with ash to a naturally regrowing one, are: persons employed by a forest district and persons in nature conservation/ planning. Especially a large proportion of the experts trained in biology had the correct perception of the preferences of the population.

The Silvicultural System

Number of tree species in the stand

Of the many subjects relevant to the silvicultural system, only the number of tree species in the stand is under investigation here. The population prefer old beech forest with self-seeding regeneration to mixed species forest,

Table 1: Comparisons between the mean difference of the preference ratings of the four types of landscape as assessed by the general population and percepted by various groups of experts. (The SBE Method).

Segment	*n*	Mean Difference					
		BROAD *minus* CONIF	BROAD *minus* CSIDE	BROAD *minus* FAC	CONIF *minus* CSIDE	CONIF *minus* FAC	FAC *minus* CSIDE
GENERAL POPULATION (from *Koch* and *Jensen* 1988)	95	0.33	1.49	0.43	1.16	0.10	1.06
TOTAL OF EXPERTS	344	1.32	2.11	0.78	0.80	-0.54	1.33
Expert							
Managers	237	1.33	2.22	0.53	0.89	-0.80	1.69
Students	107	1.29	1.87	1.33	0.58	0.04	0.54
Education							
Forest ranger	102	1.21	2.10	0.34	0.90	-0.87	1.76
Master of forestry	62	1.32	1.90	0.31	0.58	-1.01	1.59
Landscape architect	47	1.65	2.89	1.04	1.23	-0.62	1.85
Occupation							
Forest owner	14	0.99	2.09	0.39	1.10	-0.59	1.70
Employed by forest district	105	1.20	2.16	0.28	0.96	-0.92	1.88
Trained in forestry - not employed by forest district	44	1.28	1.76	0.35	0.48	-0.92	1.40
Landscape architect/architect	36	1.53	2.95	0.92	1.42	-0.62	2.03
Nature conservation/planning	4	1.38	2.65	1.38	1.28	-0.00	1.28
Master Study							
Forestry	33	1.41	1.28	1.46	-0.12	0.05	-0.17
Landscape architecture	36	1.57	2.01	1.22	0.44	-0.35	0.79
Agriculture (agronomy)	12	1.07	1.83	2.20	0.76	1.13	-0.38
Registered land surveyor	20	0.81	2.60	1.09	1.80	0.29	1.51

Note: BROAD=Broadleaved Forest; CONIF=Coniferous Forest; CSIDE= The Countryside, FAC=Forest with Recreation Facilities; n=Number of Respondents.

consisting of trees like: birch, beech, oak and Norway spruce - at different ages. Table 2, slide pair no. 4, shows that the experts in general judged correctly. A relatively large group of the managers educated in forestry and especially persons employed by a forest district, had the correct perception of the preferences of the population. The relatively large numbers in the "indifference group" perhaps indicate that the experts had some difficulty in assessing this topic. The students perhaps had the greatest difficulty, as they were almost equally divided between the two forest environments and indifference.

Table 2: Comparisons between the mean assessment of the Danish population and the distribution in % of the experts' perception of population preferences as regards various forest management topics. (The Experimental Method).

Slide pair no.	Topic The topic preferred by the general population is underlined		Segment of Experts			Segment of Managers -Education-				Segment of Managers -Occupation-				Segment of Students -Master Study-			
		TOTAL OF EXPERTS	Managers	Students	Politicians	Forest ranger	Master of forestry	Landscape architect	Biologist	Forest owner	Employed by forest district	Trained in forestry - not employed by forest district	Nature conservation/planning	Forestry	Landscape architecture	Agriculture (agronomy)	Biology
1	Grassland	36	43	24	20	43	53	42	45	27	55	38	46	35	19	15	26
	Old beech forest	54	45	67	60	45	37	46	55	64	27	53	39	56	73	83	57
	Indifference	11	12	9	20	13	10	12	0	9	18	9	15	8	8	2	17
2	Old Norway spruce (summer)	9	11	7	13	11	14	2	9	14	18	9	13	2	8	9	13
	Old beech forest (summer)	72	68	81	53	59	67	78	73	59	58	62	74	89	73	87	61
	Indifference	19	22	13	33	30	19	20	18	27	24	29	13	9	19	4	26
3	Young Norway spruce (winter)	24	27	21	13	20	36	20	27	32	42	26	20	37	17	24	9
	Young beech forest (winter)	43	39	46	73	55	26	41	45	41	36	41	33	24	45	59	48
	Indifference	33	34	33	13	25	37	39	27	27	21	33	46	39	38	17	43
4	Mixed species forest (selection system)	28	26	30	43	34	19	17	55	48	15	24	24	40	32	26	13
	Old Beech forest with self-seeding regeneration	40	43	36	36	43	50	41	18	48	73	45	37	29	30	37	43
	Indifference	32	31	35	21	23	31	41	27	5	12	30	39	31	38	37	43
5	Beech forest without broken tree trunk	32	30	36	20	23	33	44	18	27	48	24	30	49	36	30	30
	Beech forest with broken tree trunk	37	39	32	60	46	36	20	82	50	42	36	40	33	26	43	35
	Indifference	31	30	31	20	30	31	37	0	23	9	39	30	18	38	26	35
6	Bog planted with ash	35	38	30	33	43	41	34	27	41	55	44	46	33	31	30	0
	Naturally regrowing bog	48	48	47	53	45	47	44	73	41	39	45	43	49	50	39	60
	Indifference	18	15	23	13	13	12	22	0	18	6	11	11	18	19	30	40
7	Gnarled oaks	73	71	76	73	70	70	76	100	67	67	71	69	76	73	80	74
	Straight-stemmed oaks	17	16	17	20	18	19	15	0	24	21	18	19	18	19	13	17
	Indifference	10	13	6	7	13	11	10	0	10	12	11	13	6	8	7	9
8	Selective thinning in Norway spruce	69	69	68	80	68	71	66	91	68	76	71	72	76	63	61	70
	Thinning in rows in Norway spruce	9	9	11	7	5	8	2	0	14	3	8	6	8	15	9	9
	Indifference	22	22	21	13	27	21	32	9	18	21	21	22	16	23	30	22
9	Light thinning in Norway spruce	14	14	13	27	20	14	15	27	10	6	21	13	16	8	2	26
	Very heavy thinning in Norway spruce	53	49	60	47	46	46	56	45	57	61	41	48	51	71	63	57
	Indifference	33	37	27	27	34	41	29	27	33	33	38	39	33	21	35	17
10	Beech forest without logs and branches	57	49	68	60	55	46	46	55	41	55	55	37	73	60	62	78
	Beech forest with logs and branches	12	13	10	13	4	18	15	27	5	24	11	17	8	19	2	4
	Indifference	31	38	22	27	41	36	39	18	55	21	35	46	18	21	36	17
11	Wood without exercise structure	36	39	34	27	36	52	29	36	27	67	48	31	59	29	22	17
	Wood with exercise structure	58	55	63	67	61	38	63	64	64	24	45	65	37	69	72	83
	Indifference	5	7	3	7	4	10	7	0	9	9	6	4	4	2	7	0
12	Forest road	17	16	19	0	5	25	8	0	27	45	14	13	41	15	13	9
	Forest road with bench	68	68	67	80	77	58	80	91	73	52	61	77	53	70	72	91
	Indifference	16	17	13	20	18	16	13	9	0	3	26	9	6	15	15	0
13	Forest road with horserider	13	9	20	7	14	6	12	27	5	3	8	11	24	17	20	22
	Forest road with family	61	65	55	60	54	70	68	55	59	88	58	65	59	47	50	70
	Indifference	26	27	25	33	32	24	20	18	36	9	35	24	16	36	30	9
	Number of respondents	n= 530	313	202	15	56	118	41	11	22	31	66	54	49	48	46	23

The Choice of Tree Species

Broadleaved versus coniferous forest

All segments of the expert group have a very clear perception that the population prefer broadleaved forest to coniferous forest - which is true, cf. Table 1. (It should be remembered that it is mean assessments of broadleaved and coniferous forest which are compared - some of the SBE slides of coniferous forest are actually preferred to some of the slides of broadleaved forest by the population). - The landscape architects exhibit a strong supposition that the population prefer broadleaved to coniferous forest, cf. Table 1.

Beech versus Norway spruce forest

A topic which has been discussed for many years in Danish forestry is beech versus Norway spruce. According to the mean assessment of the population, old stands of beech rank higher in preference than old stands of Norway spruce in the summer, cf. slide pair no. 2 in Table 2. When the photos are taken in the wintertime there is no significant difference between the population's mean assessment of a stand of young beech and Norway spruce (slide pair no.3). - And if the Norway spruce had a light cover of snow, then it would presumably have been ranked highest.

Referring to the summer photos of the old stands (pair no. 2) all the groups of experts agree that the population prefer the beech to Norway spruce. The students (the agriculture and forestry students in particular) are convinced that the beech is preferred.

Referring to the winter photos of the young stands (pair no. 3 in Table 2), the experts' perception points in the right direction: a much larger proportion indicate indifference to this pair of slides than to the one with old summer stands. But a majority still believes that the population prefers young beech to young Norway spruce - especially the politicians. Only in three expert groups does a majority express indifference - namely masters of forestry, forestry students and persons in nature conservation/planning.

Regeneration, Formation and Tending of Stands

Only a limited number of the many options related to the regeneration, formation and tending of stands were studied here. In general these issues do not have great saliency for the population. This does not mean that there are not distinct preferences for different alternatives.

Method of thinning

Two thinning methods were assessed, cf. slide pair no. 8 in Table 2. The experts' perception agree with the preferences of the population - selective thinning ranks higher in preference than thinning in rows. Very few of the experts think the population prefer thinning in rows, between 0 and 15%.

Degree of thinning

The population prefer very heavy thinning to light thinning of Norway spruce. All expert groups share this perception of the populations' preferences, cf. Table 2, slide pair no. 9. A higher proportion of managers employed by a forest district, landscape architecture and agriculture students have a perception which agrees with that of the population than do the other expert groups.

Logs and branches on the forest floor

Figure 2 gives an example of the pairs of photos used in the Experimental Method. The left photo shows the same forest environment as the right photo but *after* removing logs and branches from the forest floor.

According to the mean assessment of the population, preference is given to a beech forest without logs and branches on the forest floor. Only two groups of experts do not match the preferences of the population: the forest owners and persons in nature conservation/planning, who indicate indifference to the two alternatives. The students' perceptions - especially those of the forestry and biology students - agree most with population preferences (slide pair no. 10 in Table 2).

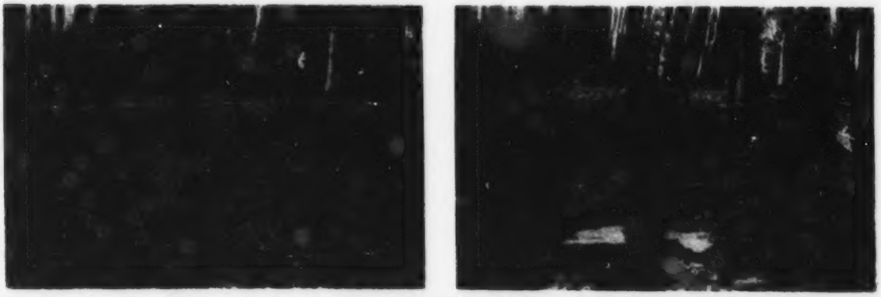

Figure 2: An example from the Experimental Method. According to the mean assessment of the population, preference is given to the beech forest *without* logs and branches on the forest floor.

Dead trees

Slide pair no. 5 in Table 2 shows the same beech forest with and without a broken tree trunk: the latter photo is taken after cutting and lugging the trunk. The population gives preference to the beech forest without the dead trunk. The experts differ greatly on this question. Taking all experts together, there is a slight majority for the perception that the population prefer the beech forest with a broken tree trunk. But looking at the different segments in Table 2 it can be concluded that six segments have the forest with the dead tree as the one the population prefer; three segments have the forest without the dead tree; while three indicate indifference. The politicians and even more so the biologists have the misperception that the population prefer the forest with the dead tree (60 and 82%). (In this connection it should be noted that only 11 biologists answered the question).

Stem form

A significant difference was expected between the population's mean assessment of a gnarled oak stand and a straight-stemmed oak stand - in favour of the gnarled stand, as in a preliminary survey made by *N. E. Koch* in 1974. But no difference was found in the national survey (slide pair no. 7 in Table 2). The experts also thought that preference was given to gnarled stands. It was in the assessment of this topic (and the beech/Norway spruce issue) that the expert groups agreed most with one another. All the expert groups had the "wrong" perception - that there was a preference, varying between 67 and 100%, for the gnarled oak stand. The forest rangers and persons in nature conservation/planning indicated the greatest "indifference" to the issue - but still only by 13%. It was among the forest owners, that the proportionally highest number thought that preference was given to the straight-stemmed stand (24%). In particular, biologically-trained respondents and the agriculture students thought preference (as expected) was given to the gnarled stand (100 & 80%).

Recreation Facilities

In the national survey of the preferences of the Danish population, very many questions related to recreation facilities were investigated. This is partly due to the cost of these facilities to The National Forest and Nature Agency and private forest owners; and partly because the topics have a relatively high saliency for the population.

Recreation facilities in general

In general the population prefers a forest without recreation facilities, - and is indifferent to whether the forest concerned is broadleaved or coniferous. Here the experts are mistaken. Only when the standard of reference is broadleaved forest do the experts have the right perception of the preferences of the population. In the case of coniferous forest, the experts are sure that the population prefers a forest with recreation facilities, cf. Table 1. The mean difference in the population (0.10) indicates some indifference between coniferous forest and forest with facilities. Only the students indicate a perception of this kind. As mentioned in the paragraph on the countryside, a forest with facilities is preferred to the countryside.

Exercise structure (path)

Slide pair no. 11 in Table 2 shows the same stand with and without an exercise structure. The population prefers a wood without any exercise structure. In general the experts have the perception that the population wants a wood with an exercise structure. In Table 2 it is quite obvious that education greatly influences perceptions of the preferences of the population: the only experts with a perception which coincides with the preferences of the population are masters of forestry, forestry students, employees of a forest district and people trained in forestry - but not employed by a district. Students (apart from forestry students) and politicians give the relatively highest support to the perception that preference is given to the wood with the exercise structure. Very few of the experts indicated indifference as to whether a wood with or without an exercise structure (path) is preferred by the population. The highest percentage here was 10%.

Forest road with a bench

Table 2, slide pair no. 12, shows that the general population prefers the photo of the forest road with the discreet bench to the same road without it. All the expert groups have the same distinct perception of the preference of the population, namely that preference is given to the forest with the bench. Two segments are slightly different from the others: employees of forest districts and forestry students rate the perception that the population prefers the "clean" forest road relatively higher than the other expert groups.

Influences Related to Recreational Use

By influences related to recreational use we mean the influence of other forest visitors on the quality of a forest visit. Only one subject was investigated, the type of forest visitor.

Type of forest visitor

The same forest road as was used to assess the preference for a road with or without a bench was used to assess the preference for a family as opposed to a horserider. According to the assessment of the general population, meeting a family ranks higher than meeting a horserider, cf. Table 2, slide pair no. 13. All the different expert groups have the "right" perception, - the quality of a forest visit is higher when meeting a family than when meeting a rider. In particular, relatively many experts employed by a forest district assess meeting the family higher than meeting the rider. Compared to the assessment of the bench, a relatively higher proportion of the experts indicates a perception of "indifference" when assessing the type of forest visitor.

CONCLUSIONS

This study of different experts' perception of the forest and landscape preferences of the Danish population shows that there are more similarities than differences between the experts' perceptions and the preferences of the population. But not all issues are assessed the same way: in about one third of the issues investigated, the experts' perceptions differ from the preferences of the population.

Where do they go wrong? The experts believe that the population prefers the more natural/unmanaged forest - for example, with a broken tree trunk and gnarled oaks. The reason for this bias in the experts' perception could be the influence of the more articulate nature-conservation groups in society. There is no doubt that nature-conservation groups have pressurized forest management to preserve old and dead trees for the benefit of certain groups of fungi and fauna, and in general to take care of the remaining unmanaged forest. (It should be noted that some expert groups are aware of the preferences of the population on this topic - perhaps because of their better contact with the typical visitor). The experts also believe that a general development of recreation facilities in the forest has stronger support in the population than is actually the case. This misperception may stem from the professional attitude of managers, which suggests that it is necessary to develop the primeval environment to preserve it from abuse by the public - and is perhaps also due to manifestations by certain interest groups and individuals.

It might be expected that the politicians, "standing aloof from the world", would be further than the other "experts" from a perception which agreed with the preferences of the population. But actually an astonishing resemblance is found. Only in three situations do the politicians deviate slightly from the other groups of experts - but not in a directly opposite way. But among the experts there are differences, as already mentioned. For example, taking the politicians, managers and students together, there is a perception that the population prefers a forest with an exercise structure on a jogging path. Looking at the managers and students, we find that a majority of managers with a master degree in forestry and managers employed by a forest district have a perception which agrees with that of the population - for a forest without any exercise structure. Looking at the students, there are clear differences between the forestry and non-forestry students - where the forestry students also are in tune with the preferences of the population.

In many connections it is stated that mean considerations are dangerous to use as a factor in recreation planning and policy. If, as manager, you try to consider the "average visitor", you only satisfy a few visitors.

Therefore it is of course also difficult for the expert to judge the mean of the preferences of the population. In this survey, however, the mean assessments of the population are compared with the experts' mean assessments *and* the assessment of different groups of experts. The example mentioned above indicates that in perception surveys too it is important to look at the perceptions of different groups of experts and not only use mean considerations. The incisive statement by *Shafer*, "The Average Camper Who Doesn't Exist" (1969), can with justice also be used in connection with this perception survey - "The Average Expert (Manager-Student-Politician) Who Doesn't Exist".

As a closing remark, it is thought-provoking that the results reported in this paper in many cases resemble and elaborate the results of *Hendee* and *Harris*, who published their article, "Foresters' Perception of Wilderness-User Attitudes and Preferences" in 1970!

Finally allow me to quote *Hendee* and *Harris*:

> "...since a large share of their work results from problem users, it would be strange indeed if their perception of typical users were free of bias.
>
> ...
>
> A continuing challenge to wilderness and other resource managers is to learn about their clientele: who they are, where they come from, and how they feel about management policies." (1970).

- This still applies - at least in Denmark.

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RECREATION DEMAND RESEARCH IN A SCANDINAVIAN CONTEXT

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SUMMARY

Recreation demand in Scandinavian countries differ from many other countries because of resources and land use rights. This paper discusses a theoretical framework which has been applied to recreation demand research in Finland, and which may be adopted in other Scandinavian countries. Recreation demand studies are of two types: those which focus on the demand for recreation resources, and those which focus on individual recreation demand and the recreation demands of a population. An outdoor recreationist typology is introduced as a tool for analyzing the recreation demand of a population.

Keywords: recreation demand, outdoor recreation, forest recreation, theoretical framework

INTRODUCTION

The demand for recreation is a basic problem in the field of recreation studies. The history of outdoor recreation policies shows that problems of resource supply were of initial interest, and the analysis of demand was based on intuition for a long time. It was the large ORRRC studies in the United States that established the bases for outdoor recreation demand studies (ORRRC 1962a, 1962b, Dauite 1966).

The conventional approach to recreation demand analysis views demand as demand for opportunities or specific types of sites or resources. Clawson and Knetsch (1966,p. 41) presented an economic concept for outdoor recreation demand. Their interpretation was that demand means a schedule of volume (visits, use-days etc.) in relation to price (cost of the recreation experience). Dauite (1966) argued that there were three kind of recreation demand. One approach is to study the recreation demand for an area or a site. The other approaches are to study the recreation demand of a population or of an individual recreationist.

An important step in demand analysis and in the definitions of concepts was made in the report by United States National Academy of Sciences in 1975. In that report Driver and Brown (1975, p.77) formulate demand from a social-psychological point of view. They suggest that it is important to identify and measure the demand for recreation experiences and the social values derived from those experiences.

The definitions of the concept of recreation demand vary a lot. Demand is not limited to the economic sense, but is broaden to include behavioral concepts. The definition of demand therefore approaches the concept of need, but which is considered to be too "psychological". Recreation research has developed most intensively in the United States. In Scandinavia, recreation research has been less prominent, and the theoretical approach has to a great extent been adapted from the anglo-saxon literature.

Language, with its cultural implications, affect how concepts and their contents are interpreted and understood. In Scandinavia, the conceptual work is still going on. Recreation demand studies have been a part of the planning process, and have mostly concentrated on the intensity of resource use.

In this paper, an analysis of the theoretical bases of demand studies is approached from a Finnish point of view, although some aspects common to all Scandinavian countries are indicated.

Recreation demand in this paper is understood to be a prediction of the future outdoor recreation behavior of a population. This prediction concerns more of the trends and styles of participation in outdoor activities than, for example, numbers of visits to certain recreation sites. A model for a typology of outdoor recreationists is introduced.

THE THEORETICAL FRAMEWORK FOR RECREATION DEMAND STUDIES

Orientation of demand studies

The aim of any given demand study directs its orientation. When an agency wants to study the demand for a particular recreation area, the approach to the resource is then chosen. When the aim of the study is to learn about demand trends amongst the population, the approach is population or individual oriented.

However, it has been resource orientation studies which have dominated the field of recreation demand (Dauite 1966, van Lier 1978). Models that are able to predict the future use of a resource have been developed. The variables used differ, but they fall into two groups: those concerning the resource (location, access, physical characteristics etc.) and those concerning population (travel distances, means of travel, population structure variables) (van Lier 1973, Dweyr et al. 1986).

Population oriented demand analysis concentrates on population variables. When the possible directions of future development of outdoor recreation in whole society are examined, it is necessary to understand the connections between outdoor recreation participation and other aspects of social and economic life, but especially leisure. It is therefore necessary to study the whole framework of outdoor recreation in a society. Two approaches of demand studies are demonstrated in figure 1 as well as how these approaches refer to different levels of problem setting.

In this paper, the problem setting is concerned with questions that refer to a more general outdoor recreation policy or a policy of multiple use of forests. The demand analysis is population oriented, and focus in the future trends of forest recreation demand.

FIGURE 1. Two kinds of recreation demand: 1) demand for recreation resources, and 2) recreation demands of individuals or populations.

OBJECT	RESOURCE	INDIVIDUAL/POPULATION	
MEANS OF MEASUREMENT (examples)	number of visits	experiences	activities
	regional distribution of visits	aesthetic gains	physical fitness/ activity
	time patterns of visitation	socialization to recreation	skills
RESULT	DEMAND OF RECREATIONAL RESOURCES	RECREATION DEMAND OF INDIVIDUALS OR POPULATIONS	
	demand of land standards for the quality of facilities	psychological & physical benefits joy, happiness, health	

Framework of recreation behavior

Outdoor recreation is one form of leisure. Leisure refers both to use of time and the purpose of activity (e.g. Dumazedier 1974). The link from the sphere of outdoor recreation participation to the sphere of outdoor recreation policy has to be understood in terms of the structure of society and the role of leisure in social life. However, attempts to connect recreation studies to the larger context of society are few.

The basic framework for studying recreationist in Finland comes from the school of sociology that is called the "way of life" -approach (e.g. Roos 1988). A "leisure life style" -approach is discussed in a similar meaning (Tokarski 1984). The other theory basis comes from life cycle studies (e.g. Rapoport,Rh. and Rapoport,R. 1975). Further, social-psychological factors, the influence of needs, motives and attitudes, that are linked with personal factors are included. Finally, the limited recreation resources are considered as a filter. A model constructed for outdoor recreational behavior studies is described in figure 2.

Way of life refers to an overall condition of life. Work, leisure, housing and access to recreational resources among other things are interrelated in the way of life (Roos 1988). The stage of life is a general aspect of human life in which everyone has something common, for example, age and family structure. In the context of recreation, the stage of life regulates the disposable leisure time and physical health.

This model can be considered to be complementary to the Driver and Brown model (1975, p.73), in which the relationship between social-psychological determinant of recreation demand and the recreational satisfaction and benefits are described. In the Driver-Brown model, each step of the chain explaining the decision making process of recreation behavior considers the environmental influences separately. In the present model, those environmental influences are given a structure and content. However, stage 3 of the model, fig 2, should include an other model, e.g. Driver-Brown type of model, to explain the social-psychological system of human behavior.

Figure 2. A theoretical framework of outdoor recreation behavior.

stage 1	THE WAY OF LIFE social class, generation	
stage 2	THE LIFE CYCLE age, family life stage	
stage 3	NEEDS MOTIVES ATTITUDES	PERSONALITY FACTORS
filter	RESOURCE SUPPLY	
	OUTDOOR RECREATIONAL BEHAVIOR	

A typology of recreationists

The way of life and the life cycle stage form a two dimensional field, where both concepts get two measurable determinants (figure 3). The way of life is described by the social class factor and welfare factor. Social class is defined by occupational end educational factors. The welfare factor includes income, housing and access to outdoor recreation facilities such as car, second home, boat etc.

The way of life directs how much and in what activities a person participate. But, individuals choose also certain types of activities to express the way of life which they want to follow. Down hill skiing was a upper middle class activity and cross country skiing favored by other population groups in Finland some years ago. Now, new working class does not differ from middle class groups concerning participation rates in down hill skiing (Roos 1989).

The life cycle is characterized by available leisure time and the physical capability to participate in outdoor activities. The life cycle stage affects the recreation participation in many ways. In early midlife, many parents spend a lot of time out of doors playing with their children. Small children limit parents' participation in many activities, which are not compatible with children's interest and skills. In old age, the physical capability weakens, and one must give up participating in the physically most demanding activities even, though there is plenty of time available for participation.

The construction of a typology of outdoor recreationists discussed here is a way to make the model of figure 2 operational. Population oriented demand research often uses survey methods which produces data for this purpose.

Figure 3. Theoretical typology of outdoor recreationists.

WAY OF LIFE		STAGE OF LIFE CYCLE				
		child hood	youth	early midlife	later midlife	old age
		amount of leisure time				
status/ style	welfare	much		little		much
		physical capability				
		good				worse
upper class	high level					
middle class				types of outdoor recreationists		
working class	low level					

The typology of outdoor recreationists will form continuum of types. Among typical town population, the types of outdoor recreationists may vary from the urban upper middle class to working class ways of life, predominantly in the adult stages of the life cycle. The extremes are the young wealthy urban dweller who participates in highly demanding activities both in terms of facilities and personal skills, and the working class retiree who takes daily walks in the vicinity of his/her residence.

DISCUSSION

In Finland, research work on recreation demand has focused on population surveys in some towns, when recreational use of urban forests have been studied (Sievänen 1984a, Jaatinen 1977). In a study from a small town, a typology of eight outdoor recreation types was identified (Sievänen 1984b). The types presented middle class and working class people. Discriminating factors were time patterns of participation (weekend vc. workday participants), age, housing (down town vc.suburban) and socioeconomic variables (id.1984b).

In country like Finland, where there is plenty of land available for recreation, the recreation demand analysis is necessarily population oriented. Recreational use projections are difficult to make with methods other than population based indicators. Further, the interesting questions are the demand for certain qualities of recreational environment, and the future trends of forest recreation demand. Here a strong theoretical basis of social change and the understanding of the relating consequences to outdoor recreation are important.

The differentiation of population into "outdoor recreation types" reflects the social structure and the related demand of outdoor recreation. Outdoor recreation types also include the aspect of a generation. The many differences between outdoor recreation types of older and younger generations reflect the future changes. Already, the younger generation seems to use more high standard recreational areas than older people in Finland. The common right to use natural areas may become less important from now. That has consequences to land use allocation and to forest management policy, too.

All Scandinavian countries are very similar in terms of land available for recreation, but only Sweden constrains the whole spectrum of landscapes that are typical to Scandinavia. Norway is very rich in recreation environment, and Norwegian people are known for their intense involvement in outdoor recreation. The common rights to use land for recreational purposes are very similar in Sweden, Norway and Finland, being based of freedom of access, or "everyman's rights".

However, Denmark is different of the other Scandinavian countries in many respects. In Denmark, the landscape is dominated by agricultural land, and forested land forms isolated patches. Also, the right of access to forest land is limited in comparison to the other countries. Only day visits are allowed.

Sweden was the pioneer of recreational studies in Scandinavia. Already in the 60's, a large study of outdoor recreation were conducted (Friluftslivet i Sverige 1964). It was an ambitious attempt to study recreation demand from the population point of view. The theoretical orientation was fairly limited, however. Recently, the main progress has been made in the field of recreation economics (Kriström 1989) and landscape preference (Axelsson-Lindgren and Sorte 1984) studies.

Recreation demand studies made in Norway are to great extent very practically oriented and serve the resource allocation decision process, recreation being only one of the allocations (Friluftsliv 1985). Recent attention has been given to recreation economics (Sodal 1989).

In Denmark, in a vast research project, conducted by Koch (1978, 1980, 1984) the recreational use of forested areas was studied statistically. Denmark is the only country, where the recreation site related demand analysis has been made in a large scale, and where the kind of approach is possible.

In Scandinavia, there are plenty of recreation resources available for public. The population oriented approach in recreation demand research is therefore rather natural. The theoretical framework presented in this paper fits to the population oriented recreation demand studies especially in circumstances, where other approaches of demand studies are difficult to realize. The presented models may be adopted in Scandinavian countries.

When the recreation demand research has a powerful theory, the possibilities to benefit of the research results grow. The outdoor recreation cultures have a lot of similarities in all Scandinavian countries. That offers possibilities to adopt research results from one country to an other, if the research has a common theoretical basis.

RÉSUMÉ

Recherche sur la demande de loisir dans le contexte Scandinave

Les droits d'utilisation des sols et les droits d'accès aux terrains non-développés sont différents en Scandinavie en comparaison avec bien d'autres pays. Le but de ce papier est de présenter une base théorique pour aider structurer la recherche sur la demande de loisir en Finlande et dans d'autres pays Scandinaves. Il existe deux types de recherches sur la demande de loisir: celles qui se concentrent sur la demande d'une ressource de loisir, et celles qui s'orientent vers la demande de loisir d'un individu ou d'une population. Un typologie des visiteurs, comme un moyen d'analyse de la demande de loisir, est présenté et discuté.

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APPLICATION OF THE RECREATION OPPORTUNITY SPECTRUM IN AUSTRALIAN PARK PLANNING

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SUMMARY

The recreation opportunity spectrum planning framework is used widely in outdoor recreation management in the U.S. It is also increasingly used in other countries, including Australia. There, applications have followed U.S. examples in park and forest settings, but also have been undertaken in urban areas. The fundamental concept appears applicable to Australian conditions, but problems related to inadequate demand and supply data and the lack of clarity regarding management objectives hinders effectiveness. Nevertheless, the Australian experience has expanded applications of the ROS, particularly in more developed settings, and has helped reinforce the need to adopt the basic concept to local needs and conditions.

Keywords: Recreation planning, recreation management, technology transfer

INTRODUCTION

In the 1970's, outdoor recreation planners, managers, and researchers in the United States became increasingly concerned about the need for a framework within which decisions about recreation allocation and management could be made. This concern was driven by laws mandating integration of recreation with other land uses as well as by a recognition that growing recreational demands on a limited resource base required improved decisionmaking (Driver et al. 1987).

This concern led to development of a planning and management framework called the Recreation Opportunity Spectrum (ROS). The ROS was the result of a logical progression in thinking designed to improve the quality of recreation management. Its foundations lay in established planning frameworks such as management by objectives (MBO) as well as in other specific recreation planning systems (Brown et al. 1978). It also derived from a long-term interest in the provision of diversity in recreational settings (Manning 1985). Work by Driver and Brown (1978) and Clark and

Stankey (1979) helped integrate and operationalize these concepts into an applied planning and management framework.

At present, the ROS is the basic recreation planning framework used by the USDA Forest Service and the USDI Bureau of Land Management. Both agencies manage large tracts of public land, predominantly in the western United States and both operate within a multiple use management philosophy.

The underlying conditions that gave rise to development of the ROS were not uniquely American. Recreation planners and managers around the world face similar pressures and voice similar concerns for a framework that would promote better decisions about recreation and better integrate outdoor recreation into multiple use management programs.

The ROS has been applied in a number of other countries, including Canada, Denmark, New Zealand, and Taiwan. However, the most extensive efforts to implement the ROS concept have occurred in Australia. This paper reviews the background of this involvement, examines characteristics of Australia that might affect use of the ROS, and cites examples of Australian ROS applications. It concludes with observations about the lessons learned in this cross-cultural example of technology transfer and the implications of these lessons for use of the ROS in the United States and elsewhere.

INTRODUCTION OF THE ROS IN AUSTRALIA

Contacts among professionals from both countries in the 1970's led to an increasing awareness of the ROS by Australian planners. Information about the ROS appeared in the literature, including a special issue of the journal Australian Parks & Recreation, devoted to the ROS, with contributions by American and Australian authors. Finally, a series of three workshops were conducted in 1982, intended to provide participants with an introduction to the ROS concept as well as an opportunity to apply it to real-world examples. Nearly 100 people, representing state, local, and municipal government, academia, and private consultants, participated.

Thus, in a relatively short time, a large amount of information regarding the ROS was made available in Australia, disseminated through a variety of means and by both Americans and Australians. However, the question remains as to the basic applicability of the ROS to Australian conditions.

RECREATION PLANNING IN AMERICA AND AUSTRALIA:

SIMILARITIES AND DIFFERENCES

In the United States, the ROS system was initiated by managers and researchers in the U.S. Forest Service. This federal agency is responsible for the management of large blocks of publicly owned land. Recreation is one of a variety of uses for which the agency is responsible. Much of the land administered by the Forest Service lies in mountainous areas of the west and much of it is in areas that are lightly populated.

There are many similarities between the U.S. and Australia. Both contain large blocks of public land possessing a variety of physical-biological characteristics. Outdoor recreation is a major value to, and activity within, both societies; projected growth rates of 30 percent in many outdoor recreation activities by the turn of the century are not uncommon. Many issues facing recreation planners and managers today are indistinguishable between the two countries; growing conflicts among recreation users and between recreation and other activities, lack of coordination among suppliers, growing competition for scarce natural and fiscal resources, and increasing public demands for access to decisions about recreation management.

However, there are also significant differences between the two countries of relevance to recreation planning. Although population pressure is much greater in the United States than in Australia (248 million vs. 16 million people in a total land area that is almost the same), the highly skewed nature of population distribution in Australia leads to high use pressures in a limited area of the country; nearly 80 percent of Australia's population resides in a crescent running from Brisbane on the northeast to Adelaide on the southwest and extending only 50 km. inland. Although the world's least densely populated continent, it is, paradoxically, the most urbanized.

Institutionally, the two countries operate very differently with regard to the management of natural resources in general and outdoor recreation in particular. In the United States, the majority of outdoor recreation opportunities are located on federal lands, with the U.S. Forest Service the major supplier. In Australia, the states are the principal provisioner of opportunities with the federal government playing only a minor role. One implication of this difference is that wide variations occur from state to state in philosophy, policy, and programs related to outdoor recreation management and planning.

Another difference is the level of training and staffing in park management agencies. Although many American park officials bemoan the lack of staff to cope with burgeoning demand, their situation is luxurious compared to that found in many Australian parks where perhaps only one ranger is responsible for several thousand square kilometers. A college degree has only recently become the standard entry level requirement for Australian park managers and few possess any specialized training in recreation management.

Finally, the base of information and knowledge about recreation use in Australian parks is limited. Granted, the difference between the Australian and American situation is one of degree; adequate information regarding amounts, timing, types, and trends in use is lacking in many U.S. areas. However, in Australia, basic use information is often lacking and measures of trends often rely upon personal observation and judgment. More elaborate and sophisticated measures of preferences or motives are typically unavailable.

Despite these differences, the underlying issues and problems confronting Australian recreation planners are very similar to those in the U.S. and other industrialized societies. Consequently, it seems logical that the kind of framework and structure the ROS brings to recreation planning would be as applicable in Australia as in the U.S.

But, planning is a culturally-based activity. It rests on assumptions and values which often are not explicit or recognized. It assumes certain levels of knowledge and understanding which, in fact, may not exist. Also, because the ROS, like most planning systems, is not simple or easy to use (Clark 1982), errors in application can lead to its rejection, irrespective of it's fundamental validity.

Conversely, applications in other cultural settings can lead to new and imaginative demonstrations of the framework's value. The application within a different context, with different assumptions, questions, and institutions involved, can lead to innovative uses. Thus, we next turn to a brief review of the Australian experience in applying the ROS to discover how its application in a different cultural context has proved useful and what new insights have resulted.

EXAMPLES OF AUSTRALIAN APPLICATIONS OF THE ROS

The ROS has been applied in a variety of settings in Australia. For convenience, this paper focuses on two broad categories: (1) National park, natural area, and forest settings; and (2) urban and local government applications.

National Park, Natural Area, and Forest Applications

The initial applications of the ROS in the U.S. occurred where natural conditions prevailed and where recreation use was relatively light and often widely dispersed. Similar applications have been made in Australia.

In New South Wales, the National Parks and Wildlife Service (NPWS) was an early adopter of the ROS system. A number of individual national parks have attempted to define opportunity classes and prepared basic inventory maps of existing conditions. The concept also was used to address the question of appropriate uses within national parks.

Recently, the NPWS has turned to the ROS as a basic framework within which to develop a Recreation Management Strategy (RMS) (the basic strategy follows closely a similar project undertaken in New Zealand). The basic purpose of this exercise is to define what portion of the overall opportunity spectrum the NPWS will provide and the management actions necessary in order to provide those opportunities. The initial phase involves preparation of basic ROS inventory maps for each park and, to the extent possible, maps of adjacent opportunities. A set of proposed ROS categories has been prepared, including the criteria and standards underlying each classes definition. A lack of basic information about both current park use (and any future changes) as well as current conditions within the parks has been a major barrier to completion of this project. However, despite problems of implementation, the exercise has helped the NPWS confront the question of the appropriate role it should play in the provision of outdoor recreation opportunities. It has also highlighted the importance of basic use and resource information in planning, thereby renewing interest in acquiring such fundamental data.

The ROS is also a basic planning concept proposed for use in the development of a plan of management for the Australian Alps. This region lies athwart the state boundary between New South Wales and Victoria and also includes a portion of the Australian Capital Territory (ACT), thus involving the federal government. A tri-party memorandum of understanding between the states and the federal government calls for the preparation and implementation of a cooperative management plan for the area, with a major objective being "provision of outdoor recreation opportunities to encourage the enjoyment and understanding of the alpine environment" (Garven 1987).

Preliminary discussions regarding the use of the ROS in the Alps plan of management focus on the value of the system in identifying the range of opportunities to be provided in the area and the types of activities and associated impacts judged appropriate and acceptable. It also provides a common set of terminology among the various partners to the agreement, helps reduce variable interpretation as to what uses and impacts are acceptable or unacceptable, and, perhaps most of all, brings a rational and explicit kind of analysis to the joint planning effort by reducing the opportunity for ad hoc and incremental decisions to be undertaken.

In Victoria, conflicts between timber management and other forest uses led to the commissioning of a "Board of Inquiry into the Timber Industry" in 1984. In a submission prepared by Davey et al. (1984) regarding the impacts of timber management on recreation, the authors reported that district plans for timber harvesting did not include any reference to recreation, on the expectation that separate recreation plans would be prepared. However, very few such plans had been prepared, but, as the authors noted "timber production goes on" (Davey et al. 1984, p. 54) and, with it, significant recreation values had been lost as had major opportunities to protect, create, and restore desired recreation settings. Much of this loss could be attributed to the lack of a systematic planning system that defined recreation opportunities in explicit terms and which allowed timber planners to assess the relationship between their intended activities and existing and/or potential recreation opportunities. The authors proposed adoption of a five-category ROS planning system and used it to demonstrate how the relationship between differing recreation opportunity settings and the management of areas for timber production purposes could be assessed. Such a system, they concluded, could reduce many conflicts between timber production and recreation or hold them to acceptable levels.

A specialized application of the ROS in a national park setting is found in the work of Pitt (1982). In a study of recreational use at Carnarvon National Park in the central highlands of Queensland, Pitt examined how changes in access, facility development, and use levels led to changes in the types of opportunities provided within the park. Describing these changes as "opportunity shifts", he reported that in less than 20 years, the park had evolved from a primitive roadless tract to one in which major portions were now highly developed and modified. Pitt described three types of opportunity shifts: (1) macro-shifts, involving major changes in the fundamental character of the recreation opportunities; (2) micro-shifts, involving more subtle, less obvious changes such as site hardening, increased use densities, and more stringent management regimes; and (3) cyclic shifts, defined as periodic changes in the nature of available opportunities resulting from changing use densities between peak and off-peak periods.

This analysis provides insight regarding how recreation opportunities can be altered through either purposive or incidental changes in internal or external conditions. At Carnarvon, the observed changes typically occurred without explicit or conscious decisions by park managers to change the kind of recreational opportunities provided, a classic example of the "tyranny of small decisions" (Clark and Stankey 1979). In such a case, the process of establishing explicit management objectives is replaced by a haphazard system in which the opportunities provided are the product of a set of decisions made in response to problems and pressures, rather than any deliberate and explicit analysis. This can lead to the provision of a set of opportunities that no one considers appropriate or desired, but which nevertheless occurs because of the failure to define and assess the consequences and implications of these "problem- driven" decisions.

Urban and Local Government Applications

There has been considerable interest in Australia in applying the ROS in urbanized settings. Although the lack of experience and examples of ROS applications in such settings has led to questions concerning its applicability, the Australian experience suggests its potential values may be high.

The Parramatta River flows through Sydney, Australia's largest city with 4 million people. Heavy industrialization along the foreshore of the river, extensive run-off into the river from adjacent developed lands, and extensive shipping activity in Sydney Harbor and along the river have greatly threatened its recreational values. However, it has the potential for serving important recreational purposes for the community.

A study undertaken by the Department of Lands was designed to identify the existing supply of recreational opportunities along the foreshore of the river and to suggest what steps needed to be taken to improve the provision of recreation opportunities and to make more effective use of the existing supply (Maple et al. 1984).

The study revealed a complex, fragmented mosaic of small areas (less than 5 hectares), often controlled by more than one owner, and interwoven with adjacent residential, commercial, and industrial activities. The authors proposed a 7-category ROS system, including definitions of the characteristics and uses found in each. An effort to describe existing use relative to site capacity as well as the potential to serve other recreation opportunities was made. This analysis revealed, inter alia, that while certain opportunity types were used at or above capacity, others had considerable potential for expanded use. Nearly a third of the total area inventoried fell into a category "small isolated areas"; much of this was inefficiently used and had potential for the development of expanded opportunities. The small size and fragmented distribution greatly handicapped realization of this, however.

The authors concluded that because no formal or explicit system to manage open space within the foreshore area had previously been available, the recreational potential of the area had gone unrealized. However, the ROS-based framework helped reveal where options and alternatives for effective recreation management could be found.

Located in Canberra, Australia's federal capital, Lake Burley Griffin forms a centerpiece for recreational activity for a quarter-million persons and is a second example of the ROS applied to an urban setting. The artificial lake, first designed in 1913 but filled only in 1962, covers over 700 hectares and is surrounded by parks, playgrounds, and bike paths as well as by a number of commercial and government buildings.

The lake is a major recreational resource for local sailors. On peak summer weekends, over 100 boats may be engaged in competitive sailing with perhaps another 200 used for recreational and training purposes.

Such high use levels prompted those responsible for administration of the lake to commission a study on how sailing use might be better managed. In particular, they were interested in the development of carrying capacity guidelines for the lake, both for safety reasons and to ensure the maintenance of desired recreational experiences. The resulting study involved both a visitor survey and the development of an ROS classification scheme for the lake based upon different styles of sailing and the associated social, management, and physical factors associated with these different styles (Wood and Hooy 1982). By establishing explicit standards related to the number of hectares required per boat for each type of sailing experience, it was possible to propose a series of scenarios featuring different mixes of sailing opportunities and, with each mix, the resulting capacity of the lake. The analysis identified how different mixes met community demand, as identified in the visitor survey, and an ability to assess how different alternatives related to other sailing opportunities within the region.

A final example of ROS application in urban settings focussed on the problem of planning and managing open space in an urbanizing community and the relationship between changing allocations and recurrent costs. The study was undertaken in the Wyong Shire, a rapidly urbanizing rural area (annual population growth about 4%), located an hour's drive north of Sydney.

Increasing costs of labor, materials, and land have made it difficult for local governments to maintain standards established for the management of open space under their jurisdiction. Recurrent maintenance and operation costs often limit what can be achieved in an urban open space system. Knowing the relationship between these costs and changes in the allocation of open space from one type to another is essential information if the objectives and standards for such areas are to be met.

Cullen et al. (1987) addressed this problem initially by defining an 8-category system of open space areas within the Shire. This provided the basis for an inventory of existing opportunities and as well as a measure of the relative share each type represented of total open space area and their spatial distribution. This information was coupled with an analysis of the recurrent costs associated with each open space type. The authors then formulated a series of scenarios regarding possible future open space provision in the Shire along with their long- term fiscal consequences. This information could be compared with existing and projected budgets to determine the consequences of different open space programs.

This study was an especially interesting application of the ROS. Not only does it involve an urban application, but it also demonstrates ways in which the ROS concept helps define the consequences of alternative actions and the trade-offs involved. It helped local government decisionmakers clarify objectives with regard to open space in explicit and objective terms. Finally, it has helped stem decisions made in response to perceived popularity or apparent short-term economic benefits, but which may constitute a serious drain on the organization's long-term economic capacity to manage them at a given standard.

CONCLUSIONS

The experience in applying the ROS in Australia reveals a wide range of examples involving settings ranging from wilderness to the city. In particular, Australian applications have added considerably to our understanding of how the ROS might be applied to developed settings. This is an important contribution to the body of experience available regarding the ROS and helps balance the predominantly primitive and dispersed recreation focus reported in the U.S. literature. These examples generally have validated the underlying utility of the ROS to urban open space management and other non-dispersed recreation opportunity settings.

As in the U.S., the major use of the ROS has been in the description of existing conditions. Only limited efforts to use the ROS as a framework to undertake other planning phases have been made, such as the identification of what future recreation conditions might or should be achieved (Stankey et al. 1983) or on how future changes in demands or supply factors might influence management.

The ROS has been a valuable framework for considering questions related to defining appropriate uses and activities, particularly in national parks and areas managed for natural values. It also has served a useful purpose in considering the role of various outdoor recreation suppliers. This is especially important given growing debates over the role of national parks and similar reserves in the development of tourism (Stankey 1989).

However, the Australian experience in applying the ROS has also revealed many problems. As noted above, most applications only have involved description of existing conditions. When efforts to consider future possibilities have been made, the range of possibilities frequently is constrained by the current condition or "what is". Current condition only defines the present status and the magnitude of effort required to change to some different set of conditions; it does not control the future range of possibilities, although it is generally accepted that changing from a developed status to a more primitive condition is more difficult than the reverse (Clark and Stankey 1979).

There has been a tendency to rely excessively on the U.S. experience, sometimes to the point of adopting both categories and standards used in the U.S. Forest Service. This becomes most obvious and most inappropriate when the focus is on urban and local government areas.

There has also been a tendency to assume that the full range of recreation opportunities needs to be provided under the jurisdiction of a single supplier; that is, one organization attempts to provide opportunities from the urban to the primitive. The result of this effort is to lead to the provision of opportunities that may be inappropriate given other organizational objectives (van Oosterzee 1984).

The lack of adequate demand and supply data has handicapped application of the ROS in Australia, but again, this is a problem differing only in degree from that experienced in the U.S. On a positive note, the ROS has helped provide a rationale for, and an organizational interest in, the collection of routine use data by providing a framework within which it can be used.

Another common problem concerns the lack of specific management objectives for recreation; this equally affects recreation management in national parks, forests, and urban settings. Again, the ROS has helped to give purpose and reason to the process of establishing management objectives and helped to demonstrate why such statements are essential for effective planning and management.

Perhaps above all else, the ROS has helped identify the legitimacy and importance of recreation planning. This applies to the various settings in which recreation occurs in conjunction with other programs: with nature conservation, heritage protection, and Aboriginal management in national parks, with timber management programs in forests, and with other municipal services in urban environs. The ROS has helped define the important experiences sought by visitors, the relationship between those desired outcomes and the various activities undertaken by managers, and the relationship between recreation and the other goods and services produced by the organization.

Application of the ROS in Australia has shown that to be effective and useful, the framework must be adapted to local conditions and needs. However, this is no different than what is required for effective application of the ROS in different settings in the U.S.. The ROS provides a basic framework for thinking about recreation management and for identifying programs with an explicit recognition of their consequences and implications; it was never intended to be, nor can it successfully be applied as, a mechanistic approach to planning. The Australian experience supports the idea that the ROS can be usefully applied in a range of recreational as well as cultural settings when its underlying rationale is understood.

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Invited Paper

NEW DIRECTIONS IN FOREST MODELLING: PROCESS DYNAMICS AND INTEGRATED KNOWLEDGE PROCESSING

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SUMMARY

Descriptive (statistical) forest models cannot deal correctly with forest dynamics induced by a changing environment and complex management decisions. Reliable analysis of forest dynamics and development paths requires structurally valid process models incorporating descriptions of the physiological processes of tree growth and competition in the stand. For practical applications, structurally valid complex models must be condensed to smaller behaviorally valid models. The incorporation of basic biological principles of organization and of both qualitative and quantitative information and processes is greatly facilitated by declarative object-oriented programming and new methods of knowledge processing.

INTRODUCTION: THE INADEQUACY OF TRADITIONAL APPROACHES

Forest modelling is in a period of transition. The rapid change of environmental conditions resulting from atmospheric pollution, forest overuse and deforestation in many parts of the world has eliminated one of the essential conditions for applying descriptive models based on historic observations: environmental conditions can no longer be treated as immutables. Standard descriptive growth and yield approaches and stand models are becoming increasingly useless for middle and long-term assessment and planning, irrespective of the statistical sophistication used in deriving them (Landsberg 1986, Rauscher 1987, 1988, Host 1988, Sievänen et al. 1988, Bossel 1988).

Traditional stand growth models 'fake' forest dynamics by explicit time-dependent description of stand development, using convenient mathematical formulations (usually of the logistic type) whose parameters are adjusted to fit the observations. The 'model' is then simply another method of presenting past observations, and it cannot be legitimately used for anything deviating significantly from these observations. In particular, it does not contain even a rough description of the underlying dynamic processes driving growth, hence it could not react 'correctly' to a change of environmental conditions causing a significant change of internal dynamics.

To overcome the shortcomings of traditional forest models, a significant number of models have been developed in recent years containing explicit representations of key processes of tree growth and forest development. These models generate their own dynamics and are not - or only partially - dependent on explicit descriptions of temporal development. These simulation models fall broadly into two categories:

(1) Models whose dynamics are determined mostly by the physiological processes at the tree level (tree process models). (Some representatives: Agren and Axelsson 1980, Hari et al. 1985, Bossel 1986, Mohren 1987, Running and Coughlan 1988, Krieger et al. 1990).

(2) Models whose dynamics are determined mostly by interspecies (light) competition processes at the forest gap level (gap models). (Representatives are all descendants of the JABOWA family of models; Shugart 1984, Shugart and Seagle 1985, Solomon 1986, Pastor and Post 1986, Kienast 1987).

Future developments will probably see a merging of these concepts in order to represent forest dynamics more accurately and completely: a better representation of tree processes in gap models, and a better representation of gap processes in tree models, if they are used to represent forest development. We can therefore expect in future forest models valid descriptions of the processes determining forest dynamics both at the tree level and at the stand (gap) level.

Considering the number of relevant processes and state variables even at the tree level, which would have to be multiplied by the number of representative vegetation layers or species in the simulated forest, this modelling approach may appear to be a hopeless exercise of little practical value for forest management. However, there is hope that complex tree process models can be 'boiled down' to much more compact dynamic models preserving the essential (nonlinear) system structure and behavioral richness, which can be used for reliable predictions even under severe environmental changes. Combination of such models with a gap model approach would yield reliable descriptions of forest dynamics even under complex management and/or environmental conditions.

BEHAVIORAL VALIDITY REQUIRES STRUCTURAL VALIDITY: THE INCLUSION OF BASIC ECO-PHYSIOLOGICAL PROCESSES

Behavioral validity cannot be expected from a model structure not containing structurally valid descriptions of the processes determining the essential dynamics of the real system. Moreover, in structurally valid models, the model parameters would have corresponding (usually measurable) counterparts in the real system. 'Parameter estimation' and 'parameter fitting' therefore usually have no place in real-structure modelling - except where aggregated descriptions of micro-processes can legitimately be made (as in the photoproductivity curve). However, it may be legitimate to apply a structurally and behaviorally valid model, which has also been empirically validated at a particular site, to another site after adjusting difficult-to-determine internal parameters by fitting model output to observations at the new site.

The road to greater reliability, applicability and validity of forest models therefore appears to be the accurate representation of those processes which determine the time behavior of the real system - i.e. of trees and forests. This does not imply the inclusion of a detailed description of every process in every model, but it does mean that certain essential processes must be properly included, and that the addition of others may be required to arrive at specific answers.

Light radiation geometry: Solar position as a function of latitude and season, in connection with site-specific data on photoactive radiation (PAR), is expressly considered in most newer models: an accurate representation of primary production is otherwise not possible. In temperate and boreal regions, the shading effects by neighboring trees are much more significant than in (sub)tropical regions: these must be included (Mohren 1987, Oker-Blom et al. 1988).

Light attenuation: The correct description of forest productivity requires a consideration of the depth structure of the forest canopy, of the light attenuation within it, and of the reduced productivity of lower leaf layers. The light compensation point of (shade) leaves and the light attenuation per leaf layer in fact determine the total leaf mass in the canopy (leaf area index), and hence total canopy production as well as an important part of photosynthate consumption - both important parts of the overall energy balance determining forest growth.

Light competition: Light competition drives stand dynamics. In multi-species forests, it controls the relative advantage of certain species over others, and hence succession dynamics. It is the essential 'motor' of gap models. It requires accurate tree height modelling, and a correct representation of light attenuation and shading effects.

Photosynthesis: Accurate computation of the photoproduction in the different leaf layers of the canopy (and hence of total canopy production) also requires accurate knowledge of leaf photoproductivity as function of radiation received, with dark respiration, light compensation point and light saturation level as prominent parameters. The nonlinear dependence of photoproductivity on radiation, the nonlinear light attenuation in the canopy, and the changing light level during the daily and seasonal cycles together account for a highly nonlinear character of canopy photoproduction, which does not permit simple approximations in many applications. These effects are included in gap models such as FORSKA and PANCAKE (Fulton priv.comm.), and in tree models such as the Douglas fir model of Mohren 1987, and TREEDYN (Bossel and Schäfer 1989).

Growth dynamics: The explicit time-dependence of tree growth in most gap models (usually a logistic-type function), and the connected time-dependence of height growth, are often unsatisfactory approximations: tree growth does not follow a time schedule, but is driven by the net rate of assimilation, which strongly depends on radiation, canopy structure, water and nutrient supply, pollutant and management effects etc. Tree growth should therefore be represented by an appropriate set of differential equations, at least for the important state variables (leaf, fine root, and wood mass). In principle, the inclusion of all production and respiration rates should allow a correct description of tree dynamics from the seedling stage to senescence, without specification of explicit time-dependencies. Work is required for developing 'minimal sets' of growth equations, which allow quick but reliable computation of tree response (see also next section).

Nutrient and water effects on photosynthesis and growth: Nutrient deficiencies and water stress critically determine forest growth, and the corresponding processes should be reliably represented, at least in an aggregated form. The problem is not trivial, since soilwater and nitrogen dynamics have typical time constants of the order of hours or days, and the use of average annual values, for example, is meaningless. The best that can be hoped for is an aggregation to some 'effective' annual parameter, but this still requires a detailed analysis of the processes, and simulations of the corresponding dynamic system with a time resolution of hours.

Root competition: Little is known about root competition. Crowns can be clearly geometrically separated; the root mats of trees are interwoven in the forest floor, usually with no discernible geometric pattern. Roots are in competition for nutrients and water, yet there are observations of cooperative behavior. One should expect pronounced effects on the development of individual trees, even though this would probably not significantly affect overall forest dynamics in mono-species forests. It may however lead to species-specific advantages, and may hence affect forest succession dynamics in mixed forests.

Species-specific parameters; subspecies: Tree parameters can vary significantly among species, but significant differences have also been found amoung sub-species (Solomon priv.comm.). These differentiations are usually the result of co-evolutionary processes and hence may provide small, but crucial advantages, which then determine forest dynamics, and succession in particular. Crucial parameters (e.g. specific height growth, root growth, drought sensitivity etc.) must be identified, and determined with greater accuracy than other parameters.

Site-specific parameters: Some of the growth-determining site-specific parameters are not constants, but change with the changing ecosystem. Soil water dynamics, and nitrogen mineralization are examples. They are part of the succession-dynamics feedback loop, and should be expressly included as such. Also, despite an outwardly homogeneous appearance at a given site, forest soils may change greatly over even a small distance (Schäfer 1989). Care must therefore be taken in adopting truly representative parameters in the model.

Gap edge effects and mutual influence: The assumption inherent in many gap models, that gaps do not exert any (net) influence on each other, is strictly valid only in homogeneous forest, where the application of a gap model would make no sense anyway. In reality, the gap edge effects on neighboring forest are substantial, and should be included (as in the ZELIG model: Urban priv.comm.): light penetration and shading, evapotranspiration, mineralization, fauna (in addition to vegetation) are affected. The relative edge effects are a function of gap size, and different gap sizes favor different specialists. The gap size itself is therefore an important parameter (Levey 1988, Popma and Bongers 1988, Uhl et al. 1988). Models with gap edge effects should be tested for their sensitivity to the gap size assumption.

Pipe model theory; root-shoot balance: While some of the tree processes (e.g. photosynthesis, transpiration, light attenuation) are 'open' to direct empirical observation, other crucial processes (e.g. assimilate distribution to the different organs, fine root growth and respiration) are 'hidden' from observation, and can be parametrized only by using indirect evidence. Moreover, it is more than likely that the parameters of these processes change with tree state. These processes have a crucial effect on tree development, and hence forest dynamics. In dealing with these processes, it seems to make sense to hypothesize certain functional principles controlling assimilate distribution and growth in the sense of optimizing growth and functional balance, and/or the efficient use of assimilate, water, and nutrients. Several such principles can be formulated: pipe model theory (Shinozaki et al. 1964), root-shoot balance (Thornley 1976), allocation hierarchy (Schäfer et al. 1988). It is still not clear which of these (alone or in combination) is the most appropriate, or whether other 'decision' strategies should be considered. However, tree dynamic models are well-suited for testing competing hypothesis by comparing computed results with observations. The reliability of forest models depends on a satisfactory solution of the assimilate distribution problem. Research should therefore concentrate on this issue.

Seasonal effects; phenology: Seasonal variations of exogeneous inputs are not now considered in forest gap models, although they do produce significant seasonal and cumulative effects in tree models (and in real trees). Dealing with annual averages will not produce the same effect as singular events such as drought periods, frost, snow, monsoon, and high winds. Also, canopy production depends nonlinearly on canopy parameters and seasonal time (see above). In fact, time itself may not be the crucial variable. In agricultural models, the temperature sum has long been used instead. It appears that for specific applications gap models could be improved by introducing at least a monthly time step of calculation, with appropriate time-dependent values for seasonal variables. For temperature data, Fourier series approximations of actual weather service data, using some 60 terms, appear to provide the appropriate amount of 'realism' (Schäfer et al. 1989).

Respiration; assimilate balance: Although forest growth is the net result of a delicate balance between assimilation and respiration, the assimilate balance is not used as a driving process in any of the current forest gap models. This balance is a critical determinant of forest dynamics, especially under stress. Pollution-caused assimilate deficiency may lead to accelerated deterioration as a result of feedback processes in the tree system; corresponding breakdown effects cannot be modelled without representing the assimilate balance. Here again, more structural and functional detail will have to be added to gap models. However, even in current tree models where this balance is included in some detail, uncertainties remain for lack of reliable information about some of the processes where measurement is difficult or has simply not been done: fine root respiration and turnover, sapwood respiration, etc. More information about these processes is urgently needed, since they play a significant role in the assimilate balance, as any attempt to balance the tree's energy balance will show quickly.

OBTAINING BEHAVIORAL VALIDITY WITH A MINIMAL SIMULATION MODEL

There is a need for developing compact tree growth models which have a valid structural representation with a minimum number of state variables, and provide a valid behavioral spectrum for the range of site, climate, management and pollution conditions found in reality. Such compact models can provide reliable assessments of behavioral dynamics with a minimum of computing effort. The development of such models is a precondition for reliable assessments of forest development over long time periods and/or large areas, where a very large number of computations is required. Typical applications are assessments of regional long-term succession, of regional long-term forest management under pollution conditions, of the study of the dynamics and stability of (tropical) forest mosaics under natural and managed conditions, of simulation of landscape development, of integration of forest simulators in geographic information systems (dynamic GIS). For all of these applications, sophisticated tree models are too complex, while time-dependent growth functions are too simplistic.

There are two approaches for arriving at the minimal set of compact dynamic (differential) equations. Ideally, both of them should be used as a check on each other, under the hypothesis that both approaches will converge to the same result.

The first approach would be to start with the simplest possible formulation for the essential physiological processes, and to add sophistication as needed to obtain the required measure of behavioral validity. The process of 'complexification' would stop at this point; the current model would be the most compact behaviorally (and structurally) valid model.

The second approach would start with complex physiological models (of structural and behavioral validity) and simplify these in steps, until the required measure of behavioral validity is no longer obtained. The process of simplification would stop at this point, and the model of the previous step would be adopted as the most compact behaviorally (and structurally) valid model.

Hopefully, both approaches would meet somewhere 'in the middle', identify the same essential structure, and wind up with a compact model having only a small number of state variables. Since trees do not differ in their essential system structure, the resultant model formulation would be 'generic', i.e. applicable to other tree species and sites after being parametrized by the appropriate (real) parameters.

The development of a compact differential equation model for the tree system solves only part of the dimensional problem of (mixed) forest computer simulation models. There are three more factors which increase the number of variables to be considered by several orders of magnitude: (1) different vegetation species, (2) different stages of development, (3) spatial distribution.

It is usually neither possible nor necessary for a reliable assessment of forest dynamics to model individual tree species (tropical forests typically contain some 200 at the same site). Instead, functionally equivalent vegetation can be aggregated to strata, classes, guilds (Oldeman 1987, Bruenig 1987), or 'fake species', each characterized by typical properties and functions ('ground vegetation', 'pioneers', 'climbers'). This would not mean defining an artificial 'computer species' showing the characteristic properties, but would probably mean picking the most dominant species in each category as a representative of this class. Behavioral validity concerning overall forest dynamics can still be expected in this representation, but the number of variables would be very significantly reduced.

It was noted above that the canopy depth structure has a significant effect on canopy production and hence forest dynamics. However, evidence suggests that aggregation of the leaf 'population' in a limited number of layers (4 to 6) produces very acceptable results (experience with the PANCAKE model (Fulton priv.comm.) and the TREEDYN model (Bossel and Schäfer 1989)) while significantly cutting computing time (as compared to more standard gap models). It seems possible to combine the leaf layer approach with the functional strata approach mentioned in the previous paragraph.

Finally, computation of a forest of (unevenly) spatially distributed trees of different age and species again increases the number of variables by two orders of magnitudes. Even if this were a feasible computational approach (it isn't), it would be questionable whether the results would be any more enlightening than those obtained by the forest gap approach - where the (mixed) forest growth is essentially reduced to the mutual penetration of canopies of the different species at different heights, each having the projection area of the simulated forest 'gap' (0.01 to 0.1 ha). It appears that this very successful basic approach will remain a part of more complex forest dynamic models, even if they will contain more sophisticated eco-physiological models describing tree growth.

FOREST KNOWLEDGE PROCESSING AND DECLARATIVE PROGRAMMING

Simulation models of the complexity just described, if developed to their full potential, tax the information handling capabilities of the model developer as well as the model user. New developments in computer software and hardware can be expected to enable both to deal with this complexity better than today.

On the user side, animated three-dimensional color graphics of forest dynamics, already a possible feature of geographic information systems (J. Schaller, pers. comm.) will provide a vivid image of forest development, and will permit rapid and comprehensive assessments of the time response of forests to management, pollution impact, and the natural forces of succession and gap dynamics. Knowledge processing components can be expected to assess management impacts in computer experiments, and to provide the user with assistance in formulating sustainable management policies.

On the side of the model developer, increasing usage of declarative programming in place of procedural programming can be expected in the wake of new developments in knowledge processing.

In the traditional procedural programming, both the model and the simulation procedure are programmed in the form of an algorithm, which is then processed in a rigid sequential manner determined by the programmer. In declarative programming, qualitative and/or quantitative knowledge about system components and their relationships is entered into a knowledge base in any order. This knowledge is then processed 'intelligently' in a manner appropriate to the problem posed. Simulation is one possible use; answering questions about system components, or generating and explaining conclusions about possible impacts of certain events are other uses. Knowledge processing is already having an impact on forest modelling (see the journal 'AI applications in Natural Resource Management', Muetzelfeldt et al. 1987a,b, Rauscher and Isebrands 1988, Lorenz et al. 1989).

A key feature of many knowledge processing systems, object-oriented programming, appears to be ideally suited to forest-oriented applications. In object-oriented programming, structure and function of the real system are represented in 'objects' (such as leaves, branches, tree, stand) which may have common structure, but individual instantiation (pine1, pine2,...), and which exchange messages with other objects according to the rules and 'methods' associated with the objects. A message of 'solar radiation' to a leaf object, for example, causes a message concerning assimilation to the assimilate store, as well as a message concerning water and nutrient supply to feeder roots. This will in turn cause these objects to respond and communicate with other objects. In a stand model, the object 'pine1' will use the solar position, its own position, and the position and crown shape of 'pine2' to determine when it will be in the shade of 'pine2', and will adjust its photosynthate production accordingly.

The sequencing of these exchanges is not preprogrammed; objects initiate them as needed. This approach is therefore rather close to the biologist's point of view of a biological system. Each of the biological objects can be considered as an 'actor' receiving messages, 'acting', and sending messages. The objects and their interactions define the processing procedure for a given 'problem': structure determines function. The model development consists of defining objects, their functions and interconnections and writing this information into a knowledge base. The approach can deal both with quantitative data processing as well as the logical processing of qualitative information. This latter feature is of particular importance in ecological systems, where qualitative relationships are often of crucial importance (e.g. the presence, absence or abundance of pollinators or seed dispersers). The approach is extremely flexible, as new or better information can be added merely by changing objects, without any reprogramming whatsoever.

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STATISTICS IN FORESTRY: THE NEXT TEN YEARS

(A Case of Extrapolation Beyond the Range of the Data)

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SUMMARY

In this paper I describe the changes in statistical practices that I believe will occur in forestry over the next ten years or so. Basically, I think that we will devote a lot of effort to developing methods that capitalize on the hardware we already have. Other changes will be stimulated by persistent problems, such as forest response to environmental stresses, and the necessity to make more efficient use of data. Finally, the natural evolution of our field will lead to challenges to our usual assumptions and to greater acceptance of non–classical techniques.

INTRODUCTION

When George Gertner invited me to present this paper, he asked me to discuss what new advances I foresee occurring in statistics, and how they might impact the practice of forestry in the next ten years. As the title suggests, I will be extrapolating into the future, and we all know that no good biometrician would ever think of doing such a thing. However, this is what I was asked to do, so I'm going to do it. I offer no assurance that my projections will be either precise or accurate. I recall Lincoln's opening remarks in the Gettysburg Address: "The world will little note nor long remember what we say here today.... " and I hope the same is true of this presentation.

In large part, our statistical practices in the next decade will be dominated by methods developed to capitalize on the hardware available to us. To me it seems like in the last decade we have acquired some really neat toys, and now we have to figure out how to play with them. I know that for me, the speed at which my computer executes my instructions is *not* the bottleneck in my work. Rather it is the time it takes me to think up new instructions. As Bradley Efron has been advocating for years, our massive computational power will in large part be used in lieu of detailed theoretical derivations. Lack of mathematical closed form solutions will cease to be a matter of real concern (if they have not already). Parameter estimates will increasingly be evaluated based on computationally intensive procedures like the bootstrap and jackknife. Biometricians will become much more familiar with the advantages and disadvantages of these two seemingly similar procedures. As yet, we have only seen very elementary applications of these procedures in forestry. In the near future, we will begin to see use of much more complex and advanced versions of these statistics.

GRAPHICS

Perhaps the major change will be in our increased use of graphics in response to the the tremendous explosion in graphics software. Graphical techniques will increasingly be used in data analysis We all have read or heard that the human mind is the most advanced computer known to mankind, and graphical techniques will permit us to use our minds to a much fuller capacity. Specifically, these techniques will allow us to capitalize on the human mind's tremendous ability to recognize patterns. I think we will rely less on point estimates and conventional hypothesis testing procedures and more on systems where we can "see" the answer on a screen. I don't exactly know how the latter point will be achieved, but I am sure it will be. Graphical analysis will become *the* major component of data analysis. Through animation methods we will be able to easily move three dimensional pictures through time, thus effectively adding another dimension. Color or grayscale could also be utilized to give us, effectively, five dimensions. Alternative model forms will be evaluated by simply comparing graphical representations of their predictions, rather than by evaluating statistics such as absolute and/or squared differences. Note that our increased emphasis on graphics will require every biometrician to read Tufte's (1983) book on the visual display of quantitative information!

COMPUTATIONAL POWER

As mentioned above, our tremendous computational power will lead to substitution of computationally intensive procedures for detailed theoretical work. We may also witness a renewed interest in multivariate techniques. This time around, I think we will be paying more attention to robust, computationally sophisticated techniques like projection pursuit, and less on techniques based on the Gaussian distribution.

A great deal of effort is going to be devoted to making sophisticated models "friendly" enough for the average field forester to use independently. This has to happen because these individuals already have (or soon will have) hardware sitting on their desktops that is sophisticated enough to run our most complex models. The models will have to be linked together into some sort of Artificial Intelligence system so that field personnel will be able to ask complicated "what-if" questions without requiring the presence of a host of expert scientists to answer them.

Another change I see is in the development of methods designed for use in the field, such as Importance Sampling (see, e.g., Gregoire et al. 1986). Many foresters already carry portable computers into the field to use as data recorders, and in a decade, this will probably be the standard practice. Field forms will go the way of the punched card. Given that crews will have computers with them in the field, it only makes sense to design programs that may be executed in the field to allow crew members to consider the output while they are physically in the stand. This could eliminate a lot of measurement error, and serve as a handy check on our models.

Finally, our computational power will have an impact on forest inventory. As computation becomes cheaper and cheaper in relation to data acquisition, will will see more emphasis on sophisticated estimation techniques, like Stein–rule estimation, to allow for a reduced data collection effort. However, the few plots we do measure will be measured more intensively to get the most possible information out of them. This will occur because once the crew is at the plot, the fixed cost of getting it there has already been incurred, and the benefit of more intensive measurements will far out–weigh the marginal costs. I believe that Bitterlich's idea of permanent plots with fixed relascope mounts and very detailed measurements is basically sound, and I think that some variation of this scheme will eventually take hold.

STATISTICAL METHODS

The above changes, while involving statistics, were not presumed to be motivated by advances in the theoretical statistics (although, as Cochran has pointed out, some so–called advances in the foundations of statistics have so little practical importance that it is hard to know what constitutes an advance in statistics (recounted in Rubin (1983) p. 66). In the remainder of the paper I will focus on what changes I foresee in our statistical practices for the next decade.

Forest Response Studies

The question of the effects of environmental stresses on forest growth will be a major stimulant to advances in statistics in forestry. The lack of control treatments, and the retrospective nature of many forest response studies will lead to an increased awareness of the advantages and disadvantages of observational studies (by the way, anyone involved in or interested in forest response studies should read the many papers on observational studies and causal inference modeling by William G. Cochran, Donald B. Rubin, Paul W. Holland, and Paul R. Rosenbaum – these scientists have done a marvelous job of detailing the advantages and disadvantages of observational studies as a means of scientific inquiry). Perhaps new bias elimination techniques will be developed, so that inferences can more easily be made from observational data, but I doubt it. I think that instead we will see a shift from emphasis on a single statistically significant study to an approach which relies on amalgamating the results of large numbers of studies. Meta–analysis is a good place to begin, and I expect some interesting meta–analytic studies of forest response investigations to be published sometime in the coming decade. However, due to the tremendous diversity in forest response studies, I am not sure how useful traditional meta–analytic approaches will be. In addition, I agree with Rubin (1986) that we are not so much interested in the average growth response of all reported studies, but more in the true response that we would observe if we were able to perform an ideal study. Armed with this interpretation, *all* conventional meta–analytic approaches are dubious, and new ones need to be developed. I believe that this will happen soon (note: in some sense, meta–analysis is already common in forestry in the form of combining independent estimates of a parameter; see Burk et al 1981; Green and Strawderman 1985, 1986, 1987, 1990; Gregoire and Walters 1988).

Interest in the response of forests to environmental stress will also dictate that the current emphasis on process models will remain widespread. Entirely empirical models will soon be a thing of the past. Also, fewer models which make the implicit assumption that the future will be identical to the past will be developed. Instead the new models will require the user to specify or predict the future environmental conditions.

Finally, the forest response problem will result in much more widespread use of and appreciation of time series techniques and spatial statistics. By the end of the decade almost all forest biometricians will be intimately familiar with these two areas, rather than the small number of individuals at present.

Challenging Assumptions

I believe that our statistical analyses have come about as far as they can under the ordinary assumptions. In the next decade I expect to see all our usual assumptions (e.g., normal i.i.d. errors, squared error loss, independent variables measured without error) challenged. In particular, we will be less inclined to automatically assume that our errors have a mean of zero. This latter assumption has always bothered me in connection with predictive model building in the following way: I doubt many biometricians would be willing to argue that they ever have the "true" model (for that matter, isn't true model a contradiction in terms?). So if we agree that we probably don't have the true model (because, for example, and important variable has been excluded, or the functional form is incorrect), how can we confidently expect prediction errors to "balance out" to a mean of zero? Granted, ordinary least squares fitting of the model guarantees a mean residual of zero for the fitting data, but who cares? We don't need to predict the dependent variable for levels of independent variables observed in the fitting data; we already know what it is. How can we be sure that the mean of the residuals for the unobserved data will be zero when the model is probably incorrect? If we then accept that we are not sure that our predictions will be unbiased, then why should we demand that our estimators be unbiased? Concerns like these will stimulate more interest in and acceptance of, for example, biased estimators.

Components of variance.

Following the work of Lappi (1986) and Lappi and Bailey (1987, 1988), I think foresters will be paying much closer attention to components of variance in the construction of models. For instance, it will become widely appreciated that stands usually represent random effects. Such understanding will clear up any lingering doubts as to whether whole stand models (e.g., a Schumacher–type yield model) are biased when applied to a particular stand. The model estimates the mean volume over all stands with a given level of independent variables, say μ. But for any given stand, say stand j, the mean (*if the model is correct*) is $(\mu + \eta_j)$ where η_j is the stand effect for stand j, and $E(\eta) = 0$. Thus, for any given stand, the model is biased.

Error structures.

Related to the above, we will begin to see alternative error structures specified for models. Of course, this has already been done to some extent with the introduction of weighted least squares in forestry by Cunia (1964) and generalised least squares by Ferguson and Leech (1978), but I expect we will see a lot more work in this area. Specifically, I think we will see some work questioning whether errors are normally distributed, and some testing of alternative distributions.

Loss functions.

As we begin to question our error structures more thoroughly, we will also begin to think more carefully about our loss functions. Despite its ease of use and attractiveness for combining bias and variance, there is just no reason why squared error has to be the appropriate loss function under all circumstances. I have no trouble imagining situations where overestimation may be more costly than underestimation, or vice versa. This seems to obviously demand an asymmetric loss function. Or in some situations (say, regeneration efforts), it may be maximum loss (complete failure) that is most important. This would seem to call for minimax loss. Of course, dear to my heart is Bayes risk, which has received, to my knowledge, no attention in the forestry literature. This will inevitably change as more biometricians become familiar with Bayesian analysis.

Bayesian Inference

Lindley (1975) predicts that in the next century, Bayesian analysis will be the rule, rather than the exception, while Chernoff (1986) claims that everyone either is or soon will be a Bayesian. Basu (1980) takes the view that Bayesian analysis will become the rule only as the more established members of the statistics profession (who happen to be, generally, non–Bayesians) retire or die, leaving Bayesians in positions of influence. There is little reason to believe that non–Bayesians will someday see the light. As Basu states, "only rarely does Saul become Paul". I believe that in forestry, Bayesian ideas are already beginning to take hold. Unlike mathematical statisticians, who tend to argue the merits of Bayesian versus classical inference on theoretical and/or philosophical grounds, forest biometricians tend to be pragmatists. We use something if and when it works, and that's all the justification we need. It is now firmly established that in many instances, Bayesian and/or empirical Bayesian inference works quite well (witness the fairly widespread acceptance of Kalman Filters and Stein–rule estimators). Hence these ideas have begun to be accepted in forestry and this trend will continue in the next decade. Bayesian methods for updating models will become commonplace, as will Bayesian methods for combining data from current inventories with past inventories. Given the "one–time" nature of many of our estimation problems we will see less emphasis on "long–run" properties like bias which require the conceptualization of a large number of trials. Instead we will demand estimators that are based on other considerations, like minimaxity or "global unbiasedness" (unbiasedness under all possible priors).

There are two ideas related to Bayesian inference which I have been pushing for the last few years, and I'm going to give them another plug here. The first has to do with nomenclature. I suggest we reserve the term *empirical Bayes* for compound decision problems in which prior parameters are estimated from the current data set, as in Stein–rule estimation. This seems to be the currently accepted definition in the statistical literature. If we specify the prior based on past data, this is still true Bayes. It isn't empirical Bayes just because the prior is derived empirically (from past data). There seems to be an idea out there that the prior has to be a subjective prior in order for the inference system to be true Bayes. This is untrue. Just read Zellner (1971). In the second chapter, while introducing Bayesian inference (not empirical Bayes!) he describes a situation where the prior is based on past observations. Essentially, the idea behind Bayes is that you use all your previous information. No true Bayesian would ignore past data and use a subjective prior instead. If we must differentiate between Bayes with data–based priors and Bayes with subjective priors, I suggest we refer to the former as Bayes and the latter as subjective Bayes.

My second point is the idea, often stated even by theoretical statisticians, that Bayesians believe the parameter, say θ, to be a random variable. This is a sloppy use of language on the statisticians' part which has resulted in misunderstanding on the part of applied statisticians like ourselves. Suppose the parameter of interest is mean basal area per unit area of some stand. The Bayesian understands that there is a *true* mean basal area out there, and that if we could somehow measure all the trees instantaneously and without error, we could compute it. Bayesians are not dumb! But, a Bayesian would claim that even though θ is a fixed constant, we are uncertain about its value. Therefore, we should characterize our uncertainty through the use of the probability calculus, and assign a prior distribution to θ to quantify just how uncertain we are. It is in this sense that Bayesians consider θ to be random. A couple of good elementary references on this point are Lindley (1982) and Deely and Lindley (1981).

Prediction Variance

Following the work of Gertner (1984; 1987a, b, c), I think we will see more attempts at determining the prediction variance of our models. I think the day will finally come when a point estimate alone will be treated with justifiable derision (Along with emphasis on providing variance estimates and confidence intervals, I hope most biometricians will begin to admit that they are "closet Bayesians" in terms of interpreting confidence intervals as probability intervals!).

Estimation Under Constraints

Another troubling area for forest biometricians where I think we will see a great deal of progress in the next ten years is in estimation under constraints. For instance, we have many fancy methods, such as Stein–rule estimation, for estimating means of, say, the volume per acre of a given species in a given county. But when the volumes of all the counties have to sum to the overall state volume, or when the volume of all the species have to add to total volume, most of our fancy methods fall apart, and we are right back to $\bar{x}$. Otherwise, we employ some ad–hoc method of smoothing the fancy estimates so that they sum to the required total. I have seen concern over this problem grow over the last few years, and I think that soon someone is going to develop methods for dealing with this problem which are well–grounded in theory.

Sampling

I also believe we will begin to see more efficient statistical techniques developed for data not collected in a simple random sample. As a forester, I have *never* analyzed or seen any data that resulted from a truly simple random sample. Yet nearly all the sophisticated estimators we read about in statistical papers and texts begin with the assumption that the data are i.i.d. realizations from a simple random sample. I believe that statisticians or biometricians will soon begin to develop estimators which are optimized not only for loss functions, but also for sampling mechanisms. Of course, the current interest in purposive and/or model--based sampling will continue as foresters search for more efficient sampling schemes.

Catastrophe Modeling

Following John Jeffers' stimulating presentation at the IUFRO meeting in Berkeley in November 1988, I think we are going to see a surge of interest in modeling catastrophes. We already have a pretty good handle on how are forests are going to behave under "expected" conditions. But what will happen under unexpected conditions? This is really a more important question and as yet we have no way of answering it. As Jeffers' points out, we tend to throw away model predictions that don't conform to our sense of what should happen, and modify our models so that they do not provide such unsatisfactory predictions. However it may be that we are throwing away the most important ones! I don't know how to correct this situation, but I would guess that the solution will involve detailed process models and AI.

Chaos

I think we will begin to see applications of chaos theory and fractal geometry in forestry. As Boris Zeide (1989) says, this is one area where foresters can truly be at the cutting edge of science. I think chaos theory will be used in the analysis of growth models, most of which are nonlinear, and many of which are recursive. Attempts will be made to isolate parameter values for which these models go chaotic, and if such attempts are successful, further research will be directed at determining whether such findings are meaningful, or merely mathematical curiosities. In other words, if the growth models can go chaotic, this doesn't really tell us much. The real interest is in whether forest stands can actually grow chaotically. As for fractal geometry, we will see studies aimed at determining the fractal dimension of trees, and more specifically tree crowns. Since the fractal dimension is in some sense a measure of space occupied, I think there will be attempts made to see if there is a correlation between fractal dimension and productivity. Perhaps an estimate of the fractal dimension of stand canopies obtained form aerial photographs or satellite imagery will one day replace site index as our dominant measure of site quality.

Stochastic Differential Equations

Finally, I think growth modelers are increasingly going to attempt to use stochastic differential equations (SDEs). The method seems to be a natural because growth can certainly be handled by differential equations, and is certainly stochastic, at least as far as we can tell at present. As yet, this method has received only limited attention (García 1983, 1987). I believe there are two reasons for this; first, SDEs are complicated, and second, SDEs can become intractable in a hurry if you modify the basic, simplistic assumptions. The complexity of the method is not a valid reason for avoiding this method, but the intractability issue may be. At any rate, I am sure we will see more attempts at using SDEs to develop growth models. Only time will tell if they will be successful.

CONCLUDING REMARKS

As a final remark, I remember that a student of mine once told me that he had a colleague who wasn't interested in becoming a forest biometrician because all biometricians did was sit around and fit linear regressions all day. Well, whether this was a vaild criticism in the past or not, it certainly won't be in the future. Our work is going to become much more challenging in the next decade. A look through recent issues of such journals as *Biometrics* reveals that our work is beginning to be accepted by the statistical community at large and that we are doing some original work, rather than just applying previously developed methods to new situations. I expect this trend to accelerate in the future. Finally, I hope that within the next ten years we, as a discipline, can enact legislation requiring that any biometrician produce a note from his/her mother, advisor, or other legal guardian before fitting a multiple regression.

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STATISTICAL METHODS FOR CHANGING AND NONHOMOGENEOUS FORESTS

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SUMMARY

Statistical methods are needed to analyze changing and nonhomogeneous forests. Problems caused by changes in the structure of the forest are discussed using site-quality stand-age interactions as an example. Random parameter models can be used to describe correlation structures in nonhomogeneous forests and to predict flexibly unmeasured quantities. For instance, using simultaneous equations with random stand parameters, we can calibrate equations for tree variables and predict unmeasured stand variables from any tree and stand measurements. Relations between James-Stein, Bayesian and random parameter methods are discussed.

Keywords: random parameter, calibration, Bayesian, correlation structure

INTRODUCTION

Forest statistics is not a separate discipline that could evaluate its progress by internal criteria. Forest statistics can justify its existence as far as it can contribute to other parts of the forest science or to the general statistical methods. Forest statisticians can contribute to forest research by importing new statistical methods to old problems or problems defined by other researchers. Or, forest statisticians can formulate new problems or reformulate old problems, and then show how these problems can be solved. That is, forest statisticians can be either consultants (in broad sense) or forest researchers.

Researchers most often need statistics (statistical consultants) in order to find regularities in their data when there are irregularities present. The irregularities are classified as random errors, and statistics is needed to overcome this nuisance. The main interest lies in the fixed part of the models.

Forests are quite complicated owing to the spatio-temporal variation and the interactions between stands and individual trees. If the variation is classified as random, we can use statistical techniques and concepts to analyze and utilize the structure of the variation.

CHANGING FOREST

Models are derived assuming that the data represent some ideal population. When applying the models, we assume that we are dealing with the same population. However, forests change continuously, or the population is in applications otherwise different. Different types of changes have different consequences in statistical reasoning. In the following discussion, bias is the main concern.

Trees Change

At the first sight the simplest situation occurs when trees change but the forests as a whole remain basically the same. However, there may be pitfalls in studies where the health of trees is monitored over time by remeasuring e.g. the foliation of the same trees. Single trees become generally less healthy over time even if the forests remain equally healthy. Researchers of the annual growth variation are familiar with the problems of natural growth pattern. There is not enough knowledge of the natural variation of e.g. foliation so that the measurements could be easily standardized or trends could be separated from fluctuations.

The Structure of Forest Changes

Natural development and human intervention (forest management, change of land-use) change the structure of forests continuously. If changing stand characteristics are among the explanatory (fixed) variables, the models should remain valid. For instance, the volume/dbh relation depends on the density of the stand. A volume/dbh function not including stand density can still be unbiased for a given forest area, i.e., there will be no overall bias if we apply the model for a randomly selected tree (or stand). If the distribution of stand density varies, only models including stand density (and other relevant variables) can remain unbiased.

The bias problems are not so easy to solve with respect to variables which are unmeasurable or just happen to correlate with the dependent variable without a causal relationship. A good example is stand age/site quality (site index) interaction. Assume that the dominant height curve of a stand growing on a randomly selected site i is:

$$H_i(t) = (A+a_i)\, f_\theta(t) + e_{it}, \quad \text{or} \tag{1}$$

$$H_i(t) = A f_\theta(t) + a_i f_\theta(t) + e_{it}, \tag{2}$$

where H_i is the dominant height, t is the age of the stand, A is the mean of the scale parameter, a_i is a stand-specific random parameter with zero mean, θ is an unknown parameter vector, f is the common shape of curves, and e is a random error. That is, we have simple anamorphic site index curves. If a_i-parameters are independent of t, then $a_i f_\theta(t)+e_{it}$ in Eq. (2) is an error term with zero mean and independent of the parameters A and θ. Thus A and θ can be estimated unbiasedly either using OLS or GLS (i.e., by taking into account the correlations and heterogeneous variance implied by $a_i f_\theta(t)$). In the standard applications of the site index method, only parameter θ is needed.

Assume then that old stands are, on the average, poor (see, e.g.,Monserud 1987, or Walters *et al.* 1989). Then the random stand parameter a_i is correlated with the observed values of t and thus OLS or GLS estimates of the fixed parameters A and θ are biased (GLS estimates computed, e.g., along the lines suggested by Biging 1985 are less biased than OLS estimates if there are more height measurements for old stands). The simplest model for such data is:

$$A+a_i = BT_i + C + c_i, \text{ or} \tag{3}$$

$$H_i(t) = BT_i f_\theta(t) + Cf_\theta(t) + c_i f_\theta(t) + e_{it}, \tag{4}$$

where B and C are fixed constants ($B<0$), T_i is 'the' age of stand i (e.g. the age at the time of sampling; age T is used to compare ages of different stands, and t denotes the age of a given stand in different height measurements), and c_i is random with mean zero and is independent of T and t. Error $(c_i f_\theta(t)+e_{it})$ is now independent of t and T, and B, C and θ can be estimated unbiasedly using OLS or GLS (this is an simple alternative for the instrumental variable estimator suggested by Walters *et al.* 1989). This model has, however, other problems.

First, the 'between-stand' age T_i is highly correlated with the 'within-stand' age t. For temporary plot data T_i is equivalent to t. Thus data can probably not (definitely not for temporary plots) separate the model (4) from such model where $BT_i f_\theta(t)$ is replaced by $Bt f_\theta(t)$. Similarly, data cannot separate model (3) from alternative models for the age/site quality correlation. Statistical reasoning is here, as always, conditional: we estimate parameters assuming that the specified model is correct.

Second, the application of the model in predictions is problematic. Assume that we want to predict $H_i(t_*)$ of a randomly selected stand i without height measurements. Marginally unbiased predictions (i.e. expectation is taken over the site-index distribution) are obtained using model (2). Better predictions (conditionally unbiased with respect to T) can be obtained using model (4) which takes the correlation between age and site index into account. But how should we determine 'the' stand age T_i if we apply the model after 10 years? One solution is to use the age of the stand at the time when data were collected to fit model (4). If the structure of the forest remains the same, then better predictions are obtained using the age at the application time as T_1. This would mean that the same site is assumed to become poorer as the stand gets older.

It is a difficult task to analyze the statistical consequences of changes in a population. The naive assertion that models can just be applied in the same population used to collect the data does not help.

How to Interpret Changes in Forest

In addition to changes in forest structure, the environmental variables may change in a more or less systematic way. Both changes in forest structure and environment can be taken into account by using time-varying parameters in the models. Careful inference is needed to interpret the changes (see, e.g., Van Deusen 1987). If models are used only in inventories, then it is not usually important whether the reason for changes in the parameter values is human intervention, natural development of forest structure, or changes in environment.

It is often said that only process based models can provide causal explanation for apparent changes e.g. in growth. There is a clear reductionistic flavour in the argument. On the reductionistic road we are forced to go up to the physics before finding causal explanations. Explanations are causal enough if they are based on fertile and real invariances in the forest. If process models are used to interpret or predict real data, the disturbing statistical factors need to be taken into account.

An additional problem in many process models is the large number of parameters. Process models can provide better predictions in changing environment only if the the model forms grasp the essential features and interactions of the processes, and the parameters have reasonable values. For an overparametrized model, it is both difficult to test the structure of the model and test or estimate the parameters.

RANDOM PARAMETER APPROACH IN NONHOMOGENEOUS FOREST

James-Stein/Bayes/Random Parameter Estimates

There are several methods which all shrink estimates towards some value. The three main types could be called Bayes, James-Stein and random parameter (empirical Bayes) methods. The use of these and other related concepts is not very consistent. The main feature in James-Stein methods is that they can be used to estimate the fixed mean vector of unrelated variables. A method is 'really' Bayesian if it uses noninformative priors (as used, e.g., by Green and Strawderman 1985), or the definition or interpretation of the prior distribution of a parameter is vague or subjective. In the random parameter approach, the parameters are assumed to be random in real sense. The approaches are formally similar but conceptually different.

James-Stein estimators are based on the mathematical results which show that if we estimate simultaneously several unrelated means, the total mean square error can be decreased by shrinking the sample means towards a common value. These methods are very attractive for mathematical statisticians. Applied statistics should be disturbed by the results which show that we could get information from totally unrelated measurements. These results really deserve the name "Stein's paradox". Burk and Ek (1982) promote James-Stein estimators very carefully: "It is further assumed that the X_i's are in some manner similar (although this assumption is not necessary, it lends credibility to the use of the alternative estimator)".

Bayesian use of noninformative priors is counterintuitive. If we don't have any prior information on a parameter, we cannot get any information from noninformative priors either. Subjective priors may be useful in practical decision making. But scientific research is no simple decision making. In statistical modelling we need to apply personal judgement in many places, but using Bayesian methods we can get a false illusion that with technical derivations we can make our personal judgement more objective. For utilizing prior information in overparametrisized models, second level parameters of Finney (1979) are an alternative to Bayesian methods.

The conceptual difficulties in (subjective) Bayesian or James-Stein methods can be avoided if the unknown parameters are assumed to be random variables in the usual ('real') sense. A big part of Bayesian research treats the random parameters this way (e.g. Gertner 1984), or is not dependent on the interpretation of the priors. Random parameter models include, e.g., Kalman filter models (parameters vary over time), variance component models with random class effects and growth models where parameters of different individuals are different (see, e.g., Hsiao 1986). I think that assumption "μ_k is a random parameter with mean μ and variance σ^2" is simpler and more fertile (easier to falsify) than assumption "μ_k's are in some manner similar".

With random class parameters we can describe correlations within and between hierarchical classes (for hierarchical models see, e.g, Goldstein 1986). Another way to describe correlation structures is to let the correlation be an explicit function of the distance in time or space as is done in spatial or time series analysis. More general correlation structures are obtained by combining distance-dependent and class-dependent correlation structures.

Random Stand Parameters and Stand Variables

The use of statistical models in forest research is often a two phase process. In the analysis phase we specify models for general correlation structures, and estimate the parameters using 'good' data. The models can include several hierarchical levels (e.g., region, stand, tree), and spatial or temporal autocorrelations. In applications we predict all variables or parameters of interest using any measurements available and the 'known' correlation structure. Any knowledge of the variances of measurement errors can be easily incorporated into the model. I will outline shortly how, for instance, we can simultaneously apply models including random parameters and measurements of random variables.

Assume that for any tree i in a given stand, tree variable y_s (e.g. tree volume or height) can be expressed as:

$$y_{si} = \mu_{si} + \mathbf{z}_{si}'\mathbf{b}_s + e_{si}, \tag{5}$$

where μ_{si} is fixed mean which may be a function of other variables, $\mathbf{z}$ is vector of fixed variables, $\mathbf{b}_s$ is parameter vector which varies randomly from stand to stand with mean zero (nonzero expectations are part of μ_s), and e_{si} is random error. Parameters within vector $\mathbf{b}_s$ and across different $\mathbf{b}_s$'s (in equations for different tree variables y_s) may be correlated, and e_{si}'s of different equations may be correlated. In addition to tree variables, we may measure stand variables, which may be correlated with each other and with the **b**-parameters. Assume that we have measured some tree variables (possibly different variables for different trees) and some stand variables. We want to predict **b**-parameters of all equations for the stand and all unmeasured stand variables. Generally, if $\mathbf{y}_1$ is an observed random vector with mean μ_1 and covariance matrix Σ_1, $\mathbf{y}_2$ is an unobserved random vector with mean μ_2, and $\mathrm{cov}(\mathbf{y}_1,\mathbf{y}_2)=\Sigma_{12}$, then the best linear unbiased predictor of $\mathbf{y}_2$ is:

$$\hat{\mathbf{y}}_2 = \mu_2 + \Sigma_{12}\Sigma_1^{-1}(\mathbf{y}_1-\mu_1). \tag{6}$$

If **y** is generated according to the model:

$$\mathbf{y} = \mu + \mathbf{Z}\mathbf{b} + \mathbf{e}, \tag{7}$$

where $\mathbf{e}$ is random error with $\mathrm{var}(\mathbf{e})=\mathbf{R}$, and **b** is random parameter vector to be predicted, then the predictor will get computationally simple form:

$$\hat{\mathbf{b}} = [\ \mathbf{Z}'\mathbf{R}^{-1}\mathbf{Z} + [\mathrm{var}(\mathbf{b})]^{-1}\ ]^{-1}\mathbf{Z}'\mathbf{R}^{-1}(\mathbf{y}-\mu). \tag{8}$$

These well known formulas can be generalized into our case as follows. Stack tree measurements into vector **y** so that measurements of the same tree are below each other, and stack the $\mathbf{b}_s$-parameters corresponding to all measured tree variables into vector **b**. Then **y** can be written in form (7). Matrix **R** is block diagonal consisting of variances and covariances of e_{si}'s. If different tree variables y_s form a time series or define, e.g., a taper curve, we can specify the within-tree correlations using autoregressive processes or random tree parameters (as in Lappi and Bailey 1988). Let $\mathbf{w}$ be the vector of measured stand variables with mean μ_w. Write further:

$$\left(\mathrm{var}\begin{pmatrix}\mathbf{b}\\ \mathbf{w}\end{pmatrix}\right)^{-1} = \begin{pmatrix}\mathbf{T}_{bb} & \mathbf{T}_{bw}\\ \mathbf{T}_{wb} & \mathbf{T}_{ww}\end{pmatrix}. \tag{9}$$

It can then be shown that the best linear unbiased predictor for **b** is:

$$\hat{\mathbf{b}} = [\mathbf{Z}'\mathbf{R}^{-1}\mathbf{Z} + \mathbf{T}_{bb}]^{-1}\mathbf{Z}'\mathbf{R}^{-1}(\mathbf{y}-\boldsymbol{\mu}) - [\mathbf{Z}'\mathbf{R}^{-1}\mathbf{Z} + \mathbf{T}_{bb}]^{-1}\mathbf{T}_{bw}(\mathbf{w}-\boldsymbol{\mu}_w). \qquad (10)$$

If there is no correlation between $\mathbf{b}$ and $\mathbf{w}$, then (10) reduces to predictor (8), and if $\mathrm{var}(\mathbf{e})=\mathbf{R}$ tends to infinity, the predictor reduces to predictor (6) where $\mathbf{b}$ is predicted from $\mathbf{w}$ alone.

If $\mathbf{w}$ and true $\mathbf{b}$ were known, the random stand parameters of all equations for which we don't have any direct measurements, and all unmeasured stand variables could be predicted using the general predictor (6) and the appropriate variances and covariances. The predictor would be of the form:

$$\hat{h} = a + \boldsymbol{\lambda}'\mathbf{w} + \boldsymbol{\pi}'\mathbf{b}, \qquad (11)$$

where h is random stand parameter or random stand variable. It can be shown that the best linear unbiased predictor in the case when $\mathbf{w}$ and $\mathbf{y}$ are known is obtained by first predicting $\mathbf{b}$ using (10) and then using Eq. (11) where $\mathbf{b}$ is replaced by $\hat{\mathbf{b}}$. If $\mathbf{y}$ and $\mathbf{w}$ contain measurement errors, we just add the variances of measurement errors into the diagonal of $\mathbf{R}$ and var($\mathbf{w}$), respectively.

For instance, we can have volume/dbh and height/dbh equations with random stand parameters. Then the volume equation can be calibrated using height measurements of sample trees. The main advantage of characterizing variables and parameters as random is that we need less information in the applications. If a variable is random, it is not necessary to know its value. Random parameters can be estimated (predicted) with less data.

CONCLUDING REMARKS

Forest statisticians work between statistics and forest science, and a part of our job is to introduce new statistical methods into forest research. Almost everyone of us would like to be the first one to apply a new method in forest research (it is also nice to be the first one in some country or in certain subfield etc.). Statistical methods which are not enough known in forest research are, e.g., GLIM-models, kriging, log-linear and logit models and nonparametric density estimation.

Spatial statistics is an area where developers of methods have been interested in forestry applications. Models for tree locations are interesting, but 'what ther' question can be used to suspects their usefulness. New methods based on mark correlations (see Stoyan 1987) will provide means to analyze spatial patterns of tree characteristics.

Forest processes are complicated enough and simple enough to provide real challenges for forest statisticians. Even if I have propagated above for an approach, I do not really believe that anyone can find a methodology that could be characterized as 'the statistical foundation of forest research'. The real progress will be slow and the result of hard work.

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THE (POTENTIAL) CONTRIBUTION OF STATISTICS TO FOREST MODELLING IN THE 1990's

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SUMMARY

This paper takes a general look at the contribution that Statistics has made to forestry, and in particular forest modelling, and attempts to identify some areas in which it can potentially make a major contribution in the next decade. The emphasis is placed on application areas rather than statistical techniques, though these are given some consideration.

It is argued that a common core to Statistics, Mathematics and Computing is Modelling methodology and that this methodology can and should find application in all areas of forestry research and all levels of forest management.

The central importance of developments in both computing hard-ware and soft-ware to the application of statistical methods is highlighted.

Finally, means of communication in the area of Forest Biometry are considered, concluding with the recommendation that there should be a new International Journal of Forest Biometry.

INTRODUCTION

It is extremely unlikely that there will be any new developments in statistical technique which will have any major impact in forestry research or modelling in the next decade. Rather, existing techniques that have not so far been used will be introduced or be applied more extensively, particularly in the context of the rapidly expanding power of computer hardware and the sophistication of computer software. We must also distinguish between what could potentially happen and what is likely to happen. There is always a gap between potentiality and actuality, and the closing of this gap in the last decade of the 20th century, against the inertia which maintains the gap, is a major challenge to the community of forest biometricians.

THE HISTORICAL CONTRIBUTION OF STATISTICS TO FOREST MODELLING

Forest 'modelling' has been going on for many centuries in the form of mensurational and growth studies and the appearance of formal statistical techniques to aid these studies is a relatively recent occurrence, from the middle of this century. The traditional 'experiments' were sample plots and the main methods of 'model fitting' were graphical, with paper and pencil.

The use of least squares fitting procedures, goodness of fit tests and data splitting for validation purposes has put the traditional mensurational approach on a sound statistical basis. Even though this has been a worthwhile achievement, these models do not represent the end of progress in this area since most of the models are really only refinements in the process of describing data by simple empirical functions and therefore provide little scope for the optimisation of the overall forest management strategy.

Forest inventories also have a long pedigree. The use of statistical sampling methods to determine and improve the efficiency of such inventories has been a major area in which statistics has made a contribution to forestry practice and research.

However, the realisation that statistical methodology can and should make a contribution to all areas of forest management and research was one of the major reasons for the original formation, circa 1970, of the 'Advisory Group of Forest Statisticians' within the IUFRO framework. The original objectives of the group envisaged that it would make methodological contributions to all other groups in IUFRO, and where statistical methods were not yet being used, to propound that they should. With the change of the group's name to S.6.02, Statistical Methods, Mathematics and Computing the evangelical objective which was explicit in the former name has been lost. It would be unfortunate if the objective were also to be entirely lost. The techniques in which the members of this group have expertise are more than ever needed in all research and management activities and it is our duty to encourage their appropriate use in all areas and at all levels of forestry. In current and future times of resource limitation/scarcity it is imperative that those resources should be used efficiently to achieve maximum impact. The substance of forest research is becoming ever more complex and it is important that the scientific method in its statistical embodiment is correctly applied.

MODELLING AS A CORE CONCEPT

What is the greatest area of communality between Statistics, Mathematics and Computing?

Though there are general methodological principles within Statistics, for example randomization, stratification and blocking to avoid bias and improve efficiency, the analysis of any data set, or the optimal design of any experiment or survey involves the formulation of a model. Parsimony in the choice of models in statistics means that these models are often of a simple tractable form, for example linear or generalised linear. Statisticians have traditionally been more concerned with obtaining a simple model which 'adequately' describes the data and they have often shown little interest in a model of a form which is 'meaningful', the parameters of which have useful and realistic interpretations. Though such a limited view will still provide useful service in future, mainly in the routine design and analysis of experiments, there will be an increasing use of appropriate non-linear models generated by the scientific context in which research is done.

Mathematical modellers have in the past tended to try and construct their models on a purely theoretical basis. Their models have therefore been scientifically appropriate, but without direct quantitative comparison of models with data the scientific method is abused. Such a comparison of a mathematical model with data is of course a statistical exercise.

The modern approach to statistical modelling and mathematical modelling therefore converge in their identity. The traditional statistician and the pure mathematical modellers are incomplete in their abilities and have limited usefulness in the future of forest modelling. One of the objectives that we ought to set ourselves in the next decade, from which ever side of this dichotomy we come, is to unify our skills and techniques under a common umbrella of biometric modelling.

Finally, computing. This is now such a wide and diverse area that there can be little doubt that some aspects of it, for example, detailed consideration of the computerisation of accounting and salaries procedures, or the evaluation of competing hardware and system software would seem to me to be outside of the remit of S.6.02. However all the new innovations taking place within the area of software tools and facilities are of major concern to the biometric modeller or biometrician and will be indispensable to them if they are to suitably evolve in the application of their own disciples. In fact, many of the most useful computational tools, eg data-bases, spreadsheets, simulation and statistical packages, expert system shells are means of formulating models of the real world and therefore overlap and interrelate with the area of biometric modelling.

So, my answer to the question of what is there common to the roles played by Statistics, Mathematics and Computing, is that 'Modelling', is the essence of that common core.

MAIN AREAS OF APPLICATION

The premises that modelling and statistical methodology have an important role to play in all aspects of forest research and management and that the essence of our disciplines of mathematics, statistics and computing is 'modelling', make the title of this paper rather ambiguous when it considers what contribution statistics can make to forest modelling. I would prefer to see statistics as an integral part of the forest modelling that is to take place in the next decade than to see it as a set ossifying methods and principles to which penance needs to be paid. Major research projects of the future will be tackled by teams which will include groups of scientists together with their biometrical colleagues. Such team effort is the only way to tackle major research efforts and the powerful computing environment which will become available to these teams will give them unique opportunities of progress. Some areas where statistical ideas will make a particularly significant contribution are now briefly discussed.

Forest Growth Modelling

It is essential for forest managers to know if the additional yield from allowing the forest to continue to grow will justify the opportunity cost of doing so. An ability to determine how the forest will grow allows an economic rotation age to be determined. The traditional mensurational method of growth 'prediction' consists first of choosing a range of management practices which are thought to be acceptable by some criterion. Examples might be natural regeneration or regular planting with periodic thinning or a single final felling, or managing the forest to maintain what might be regarded as a natural mix of species and age distributions. Second, sample plots, either permanent or temporary, are set up which are then managed according the range of acceptable management practices chosen at the first stage. Finally, growth and yield are measured and descriptive relationships are then fitted to the data obtained. There has been much progress in this last stage in the last decade. Non-linear models of growth with the appropriate asymptotic properties, particularly with respect to time have been fitted by maximum likelihood methods, taking into account the covariance structure of the data in some cases. Distribution models have also been included in this framework. Such stand level models will increase in complexity and simultaneous estimation of all the parameters in the multi-variate model will be achieved. Such models are well suited to interpolation and extrapolation, in contrast to simplistic polynomial type models. Such well formulated stand-level models are also well suited to optimisation studies in which the yield is maximised with respect to the management practice variables.

A challenge which faces those who do this work is, not only the work itself, but to make sure that other workers can use the same model structure and fitting methods on a fairly easy and routine basis. A package specifically designed for forest stand level modelling would be a welcome and useful facility to mensurationists and biometricians world-wide. However the appearance of many poorly documented forest modelling packages would be counter-productive. An open access model-base which will allow comparison between different models on the same data set has been suggested and such a facility would be a valuable tool and basis for research.

The above thread of research and development has been using stand-level state variables. Another strand of work has been on individual tree models in which the forest is built up as an ensemble of trees. Such models are not going to be as convenient, at least in the next decade, as stand-level models for optimising forest management practises in situations where stand-level models are applicable. That is, in situations in which stand level data has been collected on a range of practices which is close to the optimum.

However, in the radically new situation the stand -level model is practically useless. If a new planting/thinning regime is considered, possibly in mixtures, then the individual tree model with a spatial dimension is the only sensible option. If the stand is homogeneously managed under the new scenario then the stand level model parameters could be tweaked to give some results, but without stand level data for the new practices the results would be questionable. The collection of such data from permanent sample plots is hardly feasible with the short economic horizons of the 1990's. However individual tree 'behaviour' modelling will provide models which will be credible, and the data to build such models is much cheaper and quicker to collect than the traditional sample plot data.

Much rubbish has been talked about the comparative performance of individual tree and stand level models. Various studies have come to the conclusion that a distance-dependent competition index does not perform as well as a local measure of stocking and hence reject distance dependent models in all situations. Without discussing in detail why this might have happened, (poor distance-dependent indices, differences being non-significant,...), the conclusion is logically inconsistent. The set of distance independent measures of competition are a subset of the general set of distance-dependent competition measures and a distance dependent index can always be constructed which is arbitrarily close to any distance-independent measure. The rejection of distance-dependent competition is therefore logically unjustifiable. An open grown tree has a radically different morphology to a plantation tree and it only takes a suitably heterogeneous stand to demonstrate the superiority of a non-trivial distance-dependent competition index over local stocking measures. I look forward to seeing this demonstrated in the 1990's.

If a forest growth model is required to make plausible predictions when the management or environmental input is in the form of change in nutrition, insect defoliation, or forest disease then it is obvious that they have to have appropriate state variables in the stand-level or individual-tree model to reflect the dynamic response of the forest to these inputs. The successful development of process based models will need teams which include biostatisticians/modellers, physiologists and foresters if they are to be appropriately related to data, to have scientific validity and to be relevant to forest practice and requirements.

For all forms of stand modelling appropriate data is essential. The data only has value in the context of its usefulness to the modelling it is used for and it is therefore clear that modelling considerations should determine the type of data to be collected. Unfortunately this is not generally the case. Data collection from sample plots is still being expensively collected according to guidelines set out many decades ago when mensurationists had very different conceptions of what they would do with the data than what is today considered the best way forward. Too much data is being collected in the central areas of management parameter space. The returns from adding to the central cloud of data have long ago diminished to near zero. Extra model reliability and flexibility can only be obtained by getting further data from the edges of the range of management practices. There is also an incorrect belief that the data collected in sample plots, for the purposes of growth and yield modelling should be collected in the manner which is appropriate for inventory purposes. For example, to concentrate on dbh's, choose trees for height measurement on successive occasions randomly, (so that there is very little data on the height growth of individual trees), etc. This requirement for model driven data collection is strong even for the building of the next generation of stand models, but is particularly important if individual tree modelling is to be successfully pursued.

To persuade traditional foresters/mensurationists who are in control of the resources for data collection to deviate from their tradition is one of the most important jobs for biostatisticians/modellers.

Economic and Industrial Management

The previous section was concerned with the detailed growth growth moelling with the use of economic discounting factors in the determination of optimal management being implicitly assumed. However the forest and its yield exists within a wider organisational and economic fremework. Strategic decisions on forest policy, whether to plant, what to plant and where to plant involve consideration of market expectations, risk factors, opportunity costs and operational procedures. These issues are largely the concern of senior forestry enterprise directors, who have been assisted by operational researchers and econometricians. The work of these specialists is of course based on various models, with the risk analysis involving stochastic formulations and sensitivity analysis. Analysis of risk of fire and wind damage to forest have received notable attention to date. Increased involvement of such specialists in the activities of S.6.02 would strengthen our group and the increased involvement of biometricians in such strategic analysis would be of value to the forestry industry as a whole, but also might have that beneficial side effect of convincing those who hold the purse strings of the value of modelling at all levels of forestry research and management.

Ecology and Conservation

There is more to a forest than just a collection of trees. The forest environment contains other populations of plants and animals which interrelate with the population of trees, in a competing, dependent or synergistic way. They increase the ecological diversity of the environment and hence increase its quality both for the enjoyment of mankind and for fellow species on this planet Earth. Conservation of ecological niches in the forest habitat is a responsibility which must be taken seriously.

The study of the population dynamics of these cohabiting populations, and the measurement of diversity is a complex ecological task in which biometricians have an important contribution to make. Mobile animal populations of insects, deer, squirrel and birds are difficult to measure and sampling methods which yield data which is suitable for population dynamics modelling is a field which needs a statistical input. The methods of capture-recapture, trapping, quadrat and line sampling and radio tracking involve the formulation of a range of stochastic model assumptions. These assumptions have in the past usually been of a simplistic nature, for example, that the environment is homogeneous, that all animals have equal chance of being trapped etc. These have been necessary in order that simple population parameter estimators can be used. However, in the next decade it will be possible to build fairly complex models of animal behaviour, and the relationship of this behaviour to the 'measurement' process. Some such models will be embedded in a heterogeneous mapped spatial environment. The parameters in such a population-dynamic/environmental/sampling model will be possible using standard maximum likelihood estimation procedures, the computational power being provided be the new generation of super-micros and software which will become available to ecologists. It is our job to provide such software.

An example of this type of work is the future of estimation of space use and home-range. Currently used methods usually assume that animal observations are iid and involve the estimation of the parameters of the 'stationary distribution' associated with the animal's movement pattern, either by parametric methods (ie. assuming some form of multivariate normality), or nonparametric methods, (eg. by use of kernel density estimation methods). Future work will be based on a model of the movement behaviour of the animal as it is affected by its physical requirements and interaction with its environment and other members of its own species, and with others.

Such eco-metric work will have its own academic value, but will also be of value in the management of the wildlife resource, (in the case of deer), or the control of damaging pest species, (in the case of insects, squirrel and deer). The concept of optimal management of a mixed ecological habitat will require the formulation of multi-dimensional value criteria which contain revenue from the forest enterprise as only one of the contributory factors. The concept of maximum sustainable yield has been much applied in the management of harvestable wildlife populations and is increasingly going to be applied in forest yield management with the realisation that depletion of the forest environmental resources will lead to a spiral of decline. However in the broader area of management of a complex multi-species habitat more complex calculations of optimal sustainable 'generalised yield' will be necessary.

MAIN AREAS OF STATISTICAL TECHNIQUE

The Computing * Statistics * Maths Interaction

Much of the sophisticated modelling and analysis which the bio-statistician, and even the forest researcher, now does has been made possible by the easy access to well written statistical packages which are universally available on mainframes and minis. Practically all statistical procedures can be rapidly implemented within the available packages.

There is of course some lag in our ability as practising statisticians in getting and keeping ourselves fluent in such software. The familiarity and flexibility of the transformation-regression combination in the rapid analysis of data can lead to some inertia in the hard pressed applied statistician.

Two particular limitations in the wider use of sophisticated statistical techniques in forestry have been (i) the difficulty in remembering exactly how to use commands and routines that are required relatively infrequently, and (ii) the relative slowness of the computational process when such techniques are used, particularly on large data sets. Recent developments in both software and hardware technology provide means by which these limitations will be overcome.

IKBS/Expert Systems

Intelligent Knowledge Based Systems and Expert Systems have largely been devised to aid the non-specialist to use sophisticated software in appropriate ways. The work of statisticians in forestry and ecology will increasingly involve the use of expert system front ends to software which we provide to client researchers and managers. However current work on statistical software packages involves the use of IKBS systems to aid the statistician to make full, appropriate and easy use of the statistical software that already exists. Such expert-colleague systems will overcome limitation (i) mentioned above and lead to the use of a much wider suit of statistical methodology than previously.

Parallel Computing / Super-computers

Micro-computer chips will become more powerful and cheaper. With the use of RISC and parallel processing transputers becoming more widespread most biometricians will have access to a dedicated micro-super-computer on their own desk. Such machines will be linked into a LAN which will have a server holding a full range of maintained and most recent statistical and modelling software. Such powerful tools will require us to reassess how we go about our work. No longer will we be justified in using a quick and dirty method of analysis in order to meet the pressures of high work-loads and deadlines. International communication networks will allow access to associated data from various data bases and the comparative use of a range of models developed by other workers.

The main personal problem to us will be to ensure that we keep up to date the techniques available, and to choose the appropriate time to adopt a new and improved system. We therefore need to keep a self educative component in our roles and it would probably be wise to be a couple of years behind to frontier of developments in order to avoid the debugging of prototypes and to gain the benefits of cost reduction as facilities reach a wider market.

Simulation Modelling

Stochastic simulation modelling has been with us for quite a long time. It has certainly been used extensively in growth modelling, in studies on sampling plans and in queuing situations involving the sequential use of forest harvesting and processing machinery.

Simulation models will play a significant role in the re-assessment of the kinds of models we use. With the computational power which will be available to us simple descriptive models of trend plus random variation will often be replaced by biologically appropriate stochastic simulation models. With these the deviance at just one parameter set, within a parameter fitting exercise, will be determined by the use of multiple simulation runs. Convergence to optimal parameter fits will need the use of smoothing methods and stopping rules. Within this optimal parameter fitting of stochastic simulation models the methods of optimal experimental design, using response surfaces will be used. There is work to be done on the choice of criterion of fit in such estimation. Likelihood methods will feature prominently, but it is also likely that heuristic use of functional statistics will enter into some situations particularly where spatial behaviour is involved.

Existing simulation packages have been little used by forest statisticians, possibly because they are essentially modelling tools which make little or no reference to data for parameter estimation. I believe that there will be new packages in the next decade which will remedy this.

Survey Design

Inventory

Much good technical work on the use of different probability samples and estimators has been done in the last two decades. Such work is expected to continue. However I wonder how wide the practical acceptance of such methods as 3P has been, and will be. If an established method is simple and gives reasonable results and is also accepted within a timber trading industry there can be considerable resistance to changing to a slightly more efficient estimator... "What does it matter if the error is slightly larger in one inventory than it could be; in the long term things will average out". To justify the widespread introduction of the most efficient inventory sampling methods it would be necessary to make strong and sustained arguments concerning the (substantial) cost saving in the inventory in order to achieve a given level of precision. It is possible that such arguments will be made successfully in the 1990's, but I doubt it.

Large Scale Surveys

Wide use has been made of sample survey methodology in the survey of large scale resources. Stratified, multistage, multiphase and overlapping surveys have been done which make use of auxiliary information from maps and remote imagery. Much more use will be made of such remote imagery in the future, as its resolution and computerised digital analysis techniques progress. In conjunction with such high quality global information on the population, repeated use of survey units will become more common in order to estimate changing quantities. It is possible that the remote data may become so good for many variables of interest that the ground verification stages of the a multiphase survey can be regarded as the collection of data for a calibration exercise, in which the sampling design becomes irrelevant.

The main difficulty in such surveys is at the design stage. The overall structure can often be determined by a close consideration of the population, and the objective of the survey. This requires expert statistical experience which is likely to be captured in a well designed expert system in the next decade. The other part of the design stage, that of optimal sample size determination is much more problematic. The text books fall silent after optimal allocation in stratified surveys, or the optimal secondary sample size in a two-stage survey. The literature does not help significantly with the complexities of real sample surveys. There is therefore a major requirement for a package which starts with the construction of a 'prior model' of the population to be surveyed and by the use of numerical optimisation on a simulation model of the sampling procedure produces near optimal designs of complex structure.

Experimental Design and Analysis

Design and analysis of experiments has a sound basis within statistics and it necessary that these principles continue to be widely applied. There are changes taking place with in the UIFRO groups concerned with forest experiments and growth models and it is essential that statisticians make a substantial contribution to the developments in this area.

The techniques that are most likely to be more applied in the future are those concerned with the optimal design of sequences of experiments and the use of nearest neighbour methods within spatial designs.

Other

Other specific areas of technique which will see fuller application are in : multi-variate analysis, particularly multivariate time series; non-parametric methods, with particular emphasis on the use of randomisation tests of significance; bayesian techniques, particularly in situations where there are appropriate empirical prior distributions.

The banks of statistical technique to be found in the literature which still have found relatively little application mean that there will be many other techniques that will be introduced into forestry research in the next decade.

THE FUTURE ROLE OF FOREST STATISTICIANS

Our Perceived Image and Contribution

...to Forest Researchers

This varies according to the relationship that the researchers have with statisticians.

Statisticians are sometimes primarily advisors to researchers on how they should analyze their own data, and one of the main tasks in this role is to improve the ease of access of such researchers to such statistical facilities that are available. The use of expert systems within this activity will prove a major component. There are dangers in such a role. Researchers will never really have sufficient time to devote to the consideration of the assumptions and limitations of statistical technique. There will therefore be major misunderstandings and misapplications, even with the guidance of statisticians and their expert statistical system 'colleagues'. Also, the fluency needed in order to correctly find and apply the most appropriate methods even with the computing revolution which is upon us could mean that it is far less efficient for researchers to do their own analysis than to work closely with a specialist who has the fluency.

The second role therefore is one in which the statistician provides a complete statistical service from initial design through to analysis and interpretation. In the provision of such a routine technical service, in fairly straight forward data analytical matters, it is most appropriate that such service is acknowledged and leads to junior co-authorship in cases where the data analysis is a significant part of the research work.

However it will often be the case that the research projects are so complex that there structure will be radically enhanced by statistical and modelling inputs. In such case the relationship is one of full collaboration and full co-authorship rights are appropriate.

We can act as advisors, consultants, service technicians and collaborators. All of these roles are important and it is important that the contribution that is made is recognised appropriately.

...to Senior Forestry Management

Statisticians and modellers are generally seen by senior forestry policy makers as technical specialists with little contribution to make to high level strategic decision making. However, we know that our methodology and techniques can be applied in all aspects of an organisation and we must make sure that this is known by the forest industry leaders.

FOREST BIOMETRY

- WHERE SHOULD IT GO IN THE 1990's?

In some countries the potential contribution of statistical and modelling methodology and techniques is well recognised and the difference between potentiality and actuality is small. In others, the potential contribution is not fully perceived and this is associated by appeal to traditional forestry principles and practices.

International collaboration and sharing of experiences, largely through IUFRO has been one of the major means whereby practices have been improved, and it is to be hoped this will continue. More international collaboration between forest biometricians would also be welcome. In Forestry, in contrast to some of the harder physical sciences, there has been a tendency to say "that might be fine for their conditions, but would not be appropriate here" - just another form of the 'not invented here syndrome'. Within UIFRO groups the Newsletters are a valuable and to some extent under-used means of overcoming such barriers. Certainly the contributions to the S.6.02 Newsletters giving opinions and reviews of the use of statistics in different parts of world forestry would seem to provide a good means of drawing the biometrical fraternity together.

Conferences are expensive and time consuming and on any occasion only a small fraction of all forest biometricians can attend a meeting. Conference proceedings are a valuable means of spreading experiences and results. However it is my suspicion that, generally speaking, the only references made to conference proceedings are by those who attend the conferences, and usually to their own papers!

Communication between forest biometricians takes place as a minority activity within the pages of the major forestry journals, mainly Forest Science and the Canadian Journal of Forest

Research. Even smaller is the level of communication which takes place in journals such as Biometrics, Biometrika, JASA or JRSS.

The instigation of a specialised journal in Forest Biometry has been discussed on several occasions in the last two decades without such a journal appearing. It is my belief that such an international journal would be a valuable venue for publication of biometrical research and findings and that such a journal should and will appear in the 1990's.

AKNOWLEGMENTS

The projections in a paper like this unavoidably draw upon the vast amount of published work that has appeared in our field of biometry in the past. The remit of this paper has been so wide that an attempt to reference all relevant papers would have used up all of my page allowance! I have therefore given no references, but would like to express my gratitude to all biostatisticians who have made the not inconsiderable effort to publish in the past, and hope that they publish more in the future.

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ONLINE INFORMATION ON FOREST TREES IN BIBLIOGRAPHIC DATABASES

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SUMMARY

This paper discusses a comparison of the databases AGRICOLA, AGRIS, BIOSIS Previews, CAB Abstracts and SCISEARCH on the host DIMDI, Cologne, aiming to explore the use of vocabulary relevant to forest trees in online accessible databases. A starting point was the scientific names of forest trees given in the CAB Thesaurus 1988. The information summarized in several tables covers the period 1983 to 1989. Field-specific patterns have been investigated taking Pinus sylvestris, Picea abies and Pseudotsuga menziesii as examples. Considering the different indexing practices and the variations found in the databases, it is recommended to make use of special online search facilities (online thesaurus, cross-searching, statistical analysis). This assistance will help solve the critical problem of identifying the sources required for an effective search.

Keywords: literature search, information retrieval, forestry, botanical names, terminology

ZUSAMMENFASSUNG

Informationssuche zu Waldbäumen in bibliographischen Datenbanken

Der Beitrag beschreibt einen Vergleich zwischen den Literaturdatenbanken AGRICOLA, AGRIS, BIOSIS Previews, CAB Abstracts und SCISEARCH beim Datenbankanbieter DIMDI. Das Ziel war besser zu verstehen, welches Vokabular im Zusammenhang mit Waldbäumen in direkt abfragbaren Datenbanken verwendet wird. Als Ausgangspunkt dienten die wissenschaftlichen Namen von Waldbäumen, wie sie im CAB Thesaurus 1988 aufgeführt sind. Die Vergleichsergebnisse für den Zeitraum 1983 bis 1989 wurden in Tabellen zusammengestellt. Datenfeld-spezifische Gesetzmässigkeiten wurden am Beispiel der Baumarten Picea abies, Pinus sylvestris und Pseudotsuga menziesii untersucht. Angesichts der unterschiedlichen Indexierungsarten

und der vorgefundenen Beispielsdaten wird empfohlen, verfügbare Suchtechniken (Online-Thesaurus, datenbank-übergreifendes Explorieren oder statistische Auswertungen von Abfrageergebnissen) bei der Recherche gezielt einzusetzen. Solche Instrumente helfen bei der Lösung des Grundproblems, die benötigten Informationsquellen überhaupt in eine Online-Abfrage einzubeziehen.

INTRODUCTION

Over recent years forest science has become even more complex and more specialized than it was before. Consequently, information relevant to forest science comes from quite different disciplines. The creation of new subject groups or working parties within IUFRO - a means of direct information exchange - reflects these developments. Forest trees remain, however, a common topic.

On the other hand, data in relation to forestry are stored and diffused by a still increasing number of media, e.g. printed products, magnetic tape, diskette, online databases or CD-ROM. The importance of factual databases or databases with full-text information may be rising, but bibliographic databases continue to play a role in finding references to forestry literature.

Keeping these developments in mind, this paper will focus on bibliographic databases as a source of information on forest trees. Where can one find references about forest trees in online accessible databases? Which vocabulary is used in different sources? How does a search strategy with Latin names affect the results? These and similar questions usually arise when somebody has to prepare an online search.

Finally, there is also a terminological aspect at the bottom of the retrieval problem involved. For example: Which words have the authors or indexers chosen to name a particular forest tree? Do producers of databases follow typical conventions as far as vernacular or Latin names are concerned? It seems to be clear enough that scientific names of tree species, being part of a taxonomy, could reduce the variation of terms used to a certain degree. But what is the reality an online searcher is confronted with?

METHODOLOGICAL ASPECTS

To my knowledge, there are only a few publications where databases relevant to forestry have been compared or analysed with respect to their subject coverage and the searching possibilities (see Brooks 1980, Hoover 1980, Karjalainen et al. 1983, Kempf 1988, Schrader 1987). The choice made for this paper is primarily based on retrieval experience and practical aspects of literature searching. Thus I decided to compare the databases AGRICOLA (AL), AGRIS (AG), BIOSIS (BA), CAB Abstracts (CV) and SCISEARCH (IS) on the host DIMDI (Deutsches Institut für medizinische Dokumentation und Information), in Cologne. Parts of the results were additionally checked on Data-Star, DIALOG and ESA-IRS. The time span was limited to data entered into the databases since 1983. The coverage for 1989 was as follows:

AGRICOLA	30.11.89
AGRIS	30.09.89
BIOSIS	31.12.89
CAB Abstracts	30.11.89
SCISEARCH	31.10.89 (excluding SCISEARCH-WEEKLY)

The AGRIS data for the period 1983 to 1989 were put together from two subfiles, i.e. 1983 to 1985 and 1986 to 1989. The time span on DIALOG differed slightly for SCISEARCH and AGRICOLA in 1989. The AGRIS file on DIMDI is not directly comparable with AGRIS International on DIALOG which excludes data from the U.S. input centre in order to avoid overlapping with AGRICOLA.

The comparison was done for an overall view with 330 scientific names listed in the CAB Thesaurus 1988 (p. 429-430) as narrower terms of the main heading "Forest trees". The three species with the highest number of documents referred to, Pinus sylvestris, Picea abies and Pseudotsuga menziesii, were selected to be examined in more detail. A subset of vernacular names was taken from a list in the "CAB Abstracts Online Manual, 1989 Edition" (p. 60-62).

In addition to that some databases covering agricultural and environmental sciences were analysed by means of cross-searching techniques (QUESTTOPIC on ESA-IRS, DIALINDEX on DIALOG), by using the facilities of automated statistical analysis of search results (QUESTZOOM command on ESA-IRS, EXTRACT on DIMDI), and by looking at the vocabulary and spelling variations specific to a particular search field (EXPAND command on ESA-IRS and DIALOG, DISPLAY command on DIMDI).

In this paper I did not concern myself with the appropriate use of botanical nomenclature. Assuming that authors or indexers know the relevant terminology my concerns were mainly quantitative aspects of subject coverage and formal particularities of databases when searching online.

RESULTS AND INTERPRETATION

The easiest way to start a search is when the everyday language can be used. But Table 1 shows that "Forest tree" or "Forest trees" are apparently not the best words to describe the whole concept in every database. With a second search in CAB

Abstracts, including all narrower terms of the online accessible CAB Thesaurus 1988, the number of references for the same period rose up to 33'327. The principle that indexing should be done as specifically as possible explains the difference from the 2'941 references mentioned in Table 1. Furthermore, one can see that the so-called "Basic Index" varies from database to database. This fact has to be taken into account when absolute figures are interpreted. BIOSIS Previews and CAB Abstracts, as an example, offer many abstracts to search through. In SCISEARCH the controlled terms (CT) refer to the "Research fronts", a particularity of this database. On the other hand, biosystematic codes are used in BIOSIS which replace to a certain extent the indexing of botanical names in the field CT. There is, however, an additional field with uncontrolled terms to include descriptors such as tree species. AGRICOLA and CAB Abstracts refer to the CAB Thesaurus, AGRIS to AGROVOC.

The figures given in Table 2 document the twenty most frequently referred to forest trees in CAB Abstracts since 1983. This sample was then put in relation to the most frequent species in the other databases. Looking at the absolute frequencies, CAB Abstracts usually offers the greatest number of references. This is also true for the whole set of 330 tree species. In 31 cases or almost 10% of the sample BIOSIS ranks first while AGRIS gives the highest number of bibliographic references for eight tree species, AGRICOLA for four and SCISEARCH for two. The low number of documents cited in SCISEARCH is understandable considering the fact that citation analysis is a very particular form of "indexing" so to speak and that abstracts are lacking completely.

Table 1
Searching for "Forest trees" in five selected databases, 1983-1989

Search question	AL	AG	BA	CV	IS
Forest (tree;trees)	2496	4238	556	2941	483
Forest (tree;trees)/CT	1814	3438	0	1619	303
Forest (tree;trees)/TI	742	973	266	483	182
Forest (tree;trees)/AB	4	40	292	735	0
Forest (tree;trees)/UT	0	55	71	0	0

Abbreviations:		
	/TI	limitation to the "Title"-field
	/AB	limitation to the "Abstract"-field
	/UT	limitation to the field "Uncontrolled Terms"

Source: DIMDI, 19/12/89, Entry Date ED=83 to 89xx.

Table 2
Frequency of references to Latin names of forest trees in five selected databases, 1983-1989

Search question	AL	AG	BA	CV	IS
Pinus sylvestris	1030	1444	1329	3655	355
Picea abies	825	2083	1052	3330	469
Pseudotsuga menziesii	1137	996	911	1799	69
Fagus sylvatica	198	154	380	1328	76
Leucaena leucocephala	353	443	378	1262	152
Pinus taeda	1195	1093	723	1174	80
Pinus radiata	629	466	607	1088	302
Quercus robur	200	193	366	1016	55
Pinus condtorta	620	484	538	773	82
Cryptomeria japonica	148	434	240	613	42
Pinus ponderosa	447	393	370	609	37
Picea glauca	350	202	385	583	71
Abies alba	133	323	206	576	67
Azadirachta indica	219	169	363	525	103
Pinus elliottii	432	423	320	525	22
Picea sitchensis	281	195	271	523	50
Betula pendula	172	109	304	507	47
Pinus strobus	259	194	350	496	49
Quercus rubra	219	168	270	469	42
Abies balsamea	255	147	257	467	31

Abbreviations: AL: AGRICOLA; AG: AGRIS; BA: BIOSIS Previews; CV: CAB Abstracts; IS: SCISEARCH

Source: DIMDI, 19/12/89, Entry Date ED=83 to 89xx, Basic Index.

The relative ranking of tree species in relation to the subset chosen in CAB Abstracts is illustrated in Table 3. At a first sight, the comparison of ranks in Table 3 shows a certain correspondence between the different databases. Looked at thoroughly, the figures do not give enough evidence for a clear statement on database-specific coverage of forest trees. But keeping the distribution area of a particular tree in mind Table 3 could however help to think about the regional priorities of the databases compared.

In addition to that Table 3 took my attention to another point, namely the difference in "hierarchical" concepts of "Forest trees" between the AGROVOC and the CAB Thesaurus. The reason why *Fagus sylvatica* and *Betula pendula* do not fall within the first ten percents in AGRIS for example is because AGROVOC

Table 3
The twenty forest trees most referred to in CAB Abstracts compared with their ranking in other databases, 1983-1989

Name of tree	AL	AG	BA	CV	IS
Pinus sylvestris	3	2	1	1	2
Picea abies	4	1	2	2	1
Pseudotsuga menziesii	2	4	3	3	19
Fagus sylvatica	27	*	8	4	17
Leucaena leucocephala	9	11	9	5	6
Pinus taeda	1	3	4	6	15
Pinus radiata	5	10	5	7	3
Quercus robur	25	25	11	8	23
Pinus contorta	6	9	6	9	14
Cryptomeria japonica	*	12	29	10	*
Pinus ponderosa	7	14	10	11	*
Picea glauca	11	21	7	12	18
Abies alba	*	16	*	13	20
Azadirachta indica	20	30	12	14	11
Pinus elliotti	8	13	14	14	*
Picea sitchensis	14	23	24	16	25
Betula pendula	31	*	19	17	28
Pinus strobus	17	24	13	18	27
Quercus rubra	20	31	25	19	*
Abies balsamea	18	*	27	20	*

*	Ranking not within the first 10% of the database (i.e., higher than rank 33)
Abbreviations:	AL: AGRICOLA; AG: AGRIS; BA: BIOSIS Previews; CV: CAB Abstaacts; IS: SCISEARCH

Source: DIMDI, 19/12/89.

proposes only the generic terms Fagus and Betula. A more general comparison of the two thesauri in relation to the forest tree topic is presented in Figure 1.

Since the AGROVOC thesaurus is constantly under revision, it could be that the current version differs somewhat from the status in 1982. Nevertheless, one can easily distinguish the difference in hierarchical levels. The CAB Thesaurus indicates a selection of important species while AGROVOC has weighted terms for genus and species in relation to forestry and wood production. At this point, it is necessary to notice that the reality found in the "Controlled Term"-field (CT) of the databases is not entirely covered by the printed list of the thesauri.

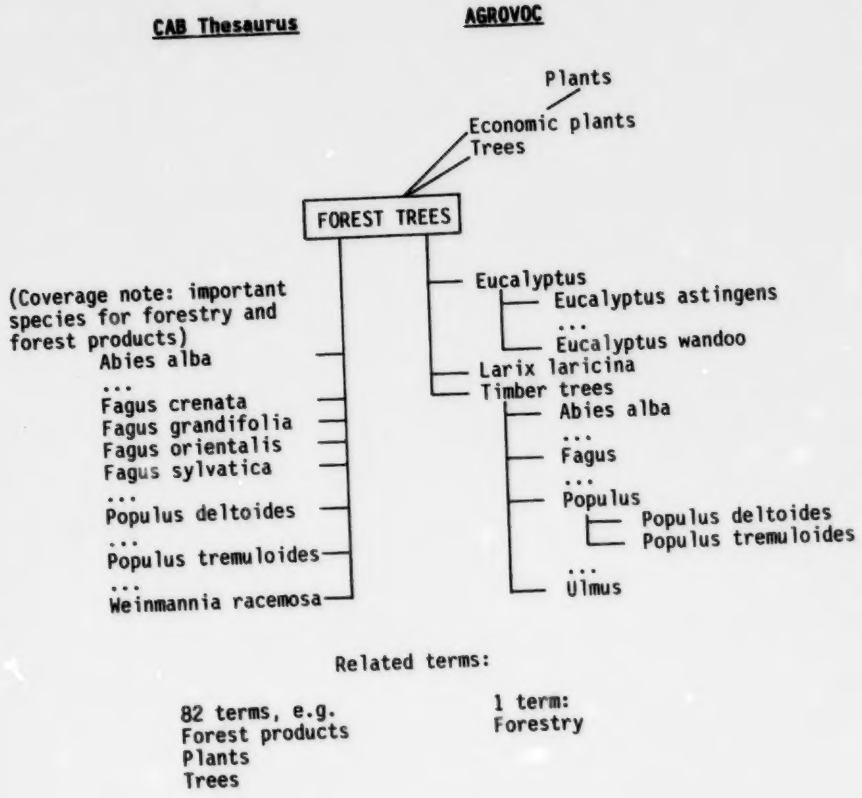
CAB Thesaurus
AGROVOC
Plants
Economic plants
Trees
FOREST TREES
(Coverage note: important species for forestry and forest products)
Abies alba
...
Fagus crenata
Fagus grandifolia
Fagus orientalis
Fagus sylvatica
...
Populus deltoides
...
Populus tremuloides
...
Weinmannia racemosa
Eucalyptus
Eucalyptus astingens
...
Eucalyptus wandoo
Larix laricina
Timber trees
Abies alba
...
Fagus
...
Populus
Populus deltoides
Populus tremuloides
...
Ulmus
Related terms:
82 terms, e.g.
Forest products
Plants
Trees
1 term:
Forestry

Figure 1
Concept of "Forest trees" in AGROVOC (1982) and in CAB Thesaurus (1988)

The variations found in absolute figures, database field structures and thesaurus concepts leads us to the second part of the explorative investigations. In order to get a better knowledge of which database to use for what purpose I did a further comparison with Pinus sylvestris, Picea abies and Pseudotsuga menziesii. Table 4 lists the samples on which the following description is based.

Focussing on the actuality of bibliographic references it transpired that BIOSIS and SCISEARCH have the fastest scanning and storing capacities. In contrast to that, CAB Abstracts and

AGRIS offered more references for a retrospective search. The results about field-specific coverage in the five databases analysed were diffuse. The sample of tree species proved to be too small. But there are still a few characteristic patterns worth discussing here.

Table 4
Number of documents on Picea abies, Pinus sylvestris and Pseudotsuga menziesii in selected databases 1985, 1987 and 1989

Name of tree	Year	AL	AG	BA	CV	IS
Picea abies	1989	42	54	89	39	118
	1987	93	463	226	362	59
	1985	100	331	125	556	35
Pinus sylvestris	1989	40	39	74	22	118
	1987	108	256	245	409	48
	1985	145	229	118	564	41
Pseudotsuga menziesii	1989	67	17	62	20	13
	1987	126	161	128	185	9
	1985	170	141	115	255	10

Abbreviations: AL: AGRICOLA; AG: AGRIS; BA: BIOSIS Previews; CV: CAB Abstracts; IS: SCISEARCH

Source: DIMDI, 21/12/89, Basic Index.

First of all, the comparison showed clearly that in the databases AGRICOLA, AGRIS and CAB Abstracts more than 95 percent of the documents covered were labelled with scientific names in the indexing field CT. Secondly, the use of Latin names in the abstracting field AB is higher in BIOSIS (30 to 70%) than in CAB Abstracts (15 to 35%). A third point to mention is the use of abbreviations for the genus. This can be found in the abstract field AB, but it usually does not reach 10% of the references. Only in a few cases does it occur without the full version, e.g. P. abies instead of Picea abies. As a consequence of the indexing practice by AGRICOLA, AGRIS and CAB Abstracts, vernacular names are, fourthly, not so important for search strategies. Common names do however play a role for information retrieval in SCISEARCH, and to a smaller extent for BIOSIS. It should be known that these two databases have only English titles. The retrieval language of another host system could influence this statement. On Data-Star, for example, all fields are included in the "Basic Index".

Based on some trials with the new command IDENTIFY DUPLICATES on DIALOG, I would also like to make mention of the large overlap between the compared databases. This is particularly true for well-known scientific journals and where Latin names of forest trees are part of a publication title.

Checking the CAB list of vernacular names mentioned above, I found that the generic names like beech, coconut, fir, oak, palm, pine, rubber or spruce are often used in bibliographic references without adding the Latin name. In some cases, of course, there cannot be a tree name reference for reasons of homonymy (e.g., palm, spruce).

To conclude, I would say that with four questions one can get a good characteristic of the vocabulary used in a particular database as far as forest trees are concerned:

a) TIT: Scientific name in the title field? (= vocabulary of the author)
b) DES: Scientific name in a descriptor field? (= indexing terms)
c) ABS: Scientific name or its abbreviation in the abstract field? (= additional information)
d) NOT: Common name mentioned without scientific term in the same document? (= vernacular versus Latin names, problem of homonymy)

A graphic representation of the results could be given in form of a wind-rose.

CONCLUSIONS

The aim of this study was to explore the use of scientific and vernacular names in different databases relevant to forestry. The search examples have lead us to a better understanding of indexing and abstracting rules and also of formal aspects. The crucial evaluation to decide wether a document retrieved by means of common or Latin names matches a particular information need or not can only be done by the user himself. The decision to compare databases on the host DIMDI excluded PASCAL which showed very good results for forest trees in the cross-searching check. Moreover, the database PASCAL offers a multilingual descriptor field (English, French and Spanish) which includes automatically added generic terms (see Botérot 1988).

In conclusion, one can point out that online searchers are faced with structured but nevertheless varying data. Another reason for variety in literature searching is the ever changing environment of information technology. Both factors influence the behaviour of researchers and intermediaries in the process of storage and retrieval of literature information. But in the end, the ability to browse and navigate in a multitude of information sources depends on a solid terminology which allows scientists to exchange knowledge and ideas without to much signal interference.

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CLASSIFICATION OF TRADITIONAL AGROFORESTRY SYSTEMS

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Quantification of the traditional agroforestry practices has always been a difficult task because of their inherent complexity and the problems faced in setting up appropriate experimental designs as pointed out by Combe and Budowski (1979). Hence, most of the studies have revolved around mere descriptions of the traditional agroforestry systems; in the process concentrating more on agroforestry plantations (Dadhwal et al., 1989, Nair, 1989). Most of these attempts formed a part of the exercise in conceptual development rather than an aid in evaluating and analysing existing agroforestry systems.

A greater need for classification of such systems was experienced and a simple calssification is given by Nair (1985), who classified the agroforestry systems as agrisilvicutural, silvipastoral, agrisilvipastoral, etc. This technique has merits and applicability but it has limitations too. Such as: different silvicultural and horticultural trees are grouped under silviculture entity; the sequential position of agriculture or silviculture or pastoral entity is fixed, whereas in nature it is not necessary that these components are always superior. Above all these systems are classified on need base, which is only applicable in specific situations. However, the complexity of the problem can be reduced if the structural, functional and agroecological aspects of the system are considered for their sequential grouping/classification. This has been done in the present tests with the help of importance value index (IVI) exercise to classify the traditional agroforestry systems of Himachal Himalayan of India. IVI not only emphasises the species density, frequency and abundance but also takes into consideration species relative status in each system.

In the Himachal Himalayan village ecosystem, three traditionally predominant agroforestry systems were studied which had agricultural, silvicultural and horticultural entities. Following the Nair (1985) classification, they should have been termed as agrisilviculture, agrihorticulture and agrihortisilviculture systems. However, through this study of sequential, ecological classification they emerged out to be sylviagriculture, hortiagriculture and hortiagrisilviculture systems, respectively. As this classification is based on the structural functional aspects of each species, the IVI values identified the sequential order of ecologically most successful/important species in the system. The predominance of the entity was clearly spelled out irrespective of its being a tree or an agricultural crop e.g., hortiagrisilviculture system. Various details of this sequential classification methodology are discussed in the present work.

SIND ELEKTRONISCHES PUBLIZIEREN, TEXTVERARBEITUNGSSYSTEME UND ANDERE TECHNISCHE, ABER AUCH WISSENSCHAFTSPOLITISCHE TRENDS URSÄCHLICH AN EINER NEUEN INFORMATIONSFLUT BETEILIGT?

MÖGLICHE AUSWIRKUNGEN AUF FORSTLICHE INFORMATIONSDIENSTE

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SUMMARY

Literature information services and libraries are presently faced with a new flood of publications in all fields of science. However, the exponential increase of scientific publications is by no means a newly discovered phenomenon. Librarians and documentalists have been complaining about the inflationary trend to more and more publications for a long time. Yet the recent development is different while mainly being caused by new systems of electronic publishing, by means of word-processing software, desk-top publishing systems etc.. Scientific authors use electronic publishing not only to improve quality but also to increase the number of their publications. They are aware that individual production figures on research papers are important as periodical proof of their scientific qualification.

Computer-aided systems of publishing not only speed up the completion of all kinds of texts. They also are a temptation to modify and integrate texts, with or without paying attention to the legal restrictions of copyright. Thus, electronic publishing increases the quantity but not neccessarily the quality of publications.

The effects of increasing quantities are a challenge to scientific information services and libraries. Database producers, information brokers and librarians alike are faced with problems of improving staff capacity and technical systems for the selection of publications according to items of quality. The consequences for user-friendly literature information services are considered by example of publications on forest decline research.

Keywords: Word processing, electronic publishing, scientific authors, editing, publication increase, information services

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*English version obtainable from the author at the Congress.

EINLEITUNG

Schon vor gut 30 Jahren, als ich begann, mich mit Systemen der wissenschaftlichen Information und Dokumentation zur Verbesserung des Wissensaustausches in Forschung und Technik zu beschäfigen und ahnte, daß die Beschäftigung mit dieser Materie oft belächelte und dennoch wichtige Lebensaufgabe werden kann, wirkten die Alarmmeldungen über die Informationslawine oder die Informationsflut motivierend genug, um den dornenreichen Berufsweg zu gehen, dessen Ziel das Ordnen, Verarbeiten und Wiederauffinden von Wissen (im Gegensatz zum Produzieren wissenschaftlicher Informationen) ist. Allerdings setzte man damals "Informationsflut" weitgehend mit der "Papierflut" gleich, denn Papier war unbestritten der dominierende Träger wissenschaftlicher Informationen. Hat sich daran wesentliches geändert? Bedient sich wissenschaftliches Publizieren heute anderer Medien? Sind diese Medien im Vormarsch? Es sind dies Fragen, deren Beantwortung eng mit dem Untersuchungsgegenstand dieser Arbeit, den inflationären Tendenzen im wissenschaftlichen Publizieren als Folge technischer, sozialer und wissenschaftspolitischer Entwicklungen, verknüpft ist.

Es ist erst wenige Jahre her, daß der PC auf dem Arbeitsplatz wissenschaftlicher Autoren und Redakteure Eingang gefunden hat. Heute ist er dort nicht mehr fortzudenken. Der Einzug des PC in Forschung und Lehre war allerdings auch mit der euphorischen Vorstellung verbunden, daß seine enormen Speichermöglichkeiten und seine von Jahr zu Jahr vielseitiger werdende Anwendersoftware mit komfortablen Benutzeroberflächen uns der faszinierenden Idee einer mit immer weniger Papier auskommenden Informationsverbreitung bis hin zur "paperless society" näher bringen würde. Doch wissen wir nun, daß das papierlose Büro und das papierlose Forschungslabor utopischen Vorstellungen entsprechen.

Es zeigt sich vielmehr, daß sich der anfangs erhoffte Trend sogar ins Gegenteil verkehrt hat: Büroarbeitsplätze in der Forschung sind so ausgestattet, daß alles und jedes wohlformatiert, mit individuellem Touch ausgedruckt und möglichst auch noch vervielfältigt werden kann. Die eher gewachsene Bedeutung von Papier haben große und kleine Software-Häuser längst erkannt. Sie bieten ihren Kunden alle technischen Hilfen an, vom einfachen Textverarbeitungsprogramm für das Editieren und Formatieren von Briefen über anspruchsvolle Word-Processing-Programme, professionelle Desk-Top-Publishing-Software bis hin zu sogenannten Hypertext-Systemen. Mit den hier erwähnten Segnungen moderner Textverarbeitungssysteme eng verbunden ist der Begriff des elektronischen Publizierens. Elektronisches Publizieren ist mehr als die computer-unterstützte Erstellung gedruckter Dokumente. Es umfaßt auch die ganze Publikationskette von der Manuskripterstellung mit einem Textverarbeitungssystem über die Bearbeitungs- und Konvertierungsgänge des Verlegers bis zum elektronisch gesteuerten Druck und der fertigen Publikation.

Es ist nicht ganz einfach, die durch diese Systeme ausgelöste Entwicklung mit statistisch gesicherten Zahlen zu belegen. In den sehr lesenswerten Proceedings der 5th Conference of Scientific Editors, die in der Zeit vom 14. bis 19. Juni 1987 in Hamburg stattfand, fand ich einen Hinweis auf Nordamerika. H.E. Kennedy, vom Biosciences Information Service (BIOSIS) erwähnte in seinem Beitrag zum Thema "The impact of technology on information transfer", daß schon 1985 als Ergebnis einer Umfrage der American Society of Publishers 80 % der befragten Autoren ihre Absicht bekundeten, Textverarbeitungsprogramme zu verwenden. Andererseits zeigten sich 70 % der Verleger bereit, elektronische Manuskripte anzunehmen. Die Zeit ist inzwischen fortgeschritten, und wir können annehmen, daß für 1990 in Europa ein ungefähr gleich großer Prozentsatz der Autoren und Verleger Methoden des elektronischen Publizierens tatsächlich praktiziert und in Nordamerika die Akzeptanz heute sogar weit über den für 1985 genannten Prozentsätzen liegen wird.

Welche Auswirkung hat diese Entwicklung nun auf das wissenschaftliche Publizieren und in welchem Kontext steht sie zu den wissenschaftssozialen und wissenschaftspolitischen Zwängen, möglichst häufig über erlangte fachliche Kenntnisse zu veröffentlichen?

PUBLIZIEREN ALS MASS FÜR WISSENSCHAFTLICHE LEISTUNG

Moderne Textverarbeitungstechniken könnten den Arbeitsplatz wissenschaftlicher Autoren nicht erobern, wenn der Zwang zum Publizieren von fertigen Ergebnissen oder Zwischenergebnissen aus Forschung und Entwicklung nicht ungebrochen wäre, ja, sich sogar verstärkt hätte.

Die Veröffentlichung des in Wissenschaft und Forschung tätigen Mitarbeiters ist und bleibt maßgebend für die Leistungsbeurteilung. Sie ist damit Maßstab für Beförderung und allgemein für beruflichen Aufstieg. Alle Bemühungen um eine formalisierte Leistungsbeurteilung unter Einbeziehung anderer leistungsbezogener und auch charakterlicher Kriterien haben nicht den gewünschten Erfolg erbracht. Sie haben sich nicht durchsetzen können.

Man mag diesen Zustand beklagen, weil oft nicht die Qualität, der Inhalt der produzierten Dokumente, sondern die Zahl der Publikationen, die Quantität, als entscheidendes Merkmal für die Qualifizierung von Wissenschaftlern dient. Dies ist ein Faktum, dessen sich viele Vorgesetzte durchaus bewußt sind: Sie erkennen und müssen sich selbst eingestehen, daß bei fortschreitender Spezialisierung in allen naturwissenschaftlich-technischen Fachbereichen eine sich ausschließlich an qualitativen Gesichtspunkten orientende Leistungsbeurteilung nicht mehr möglich ist. Als Beleg für diese Annahme mögen zwei Beispiele dienen: (1) In einem Institut, dessen Aufgabengebiet die genetische und Züchtungsforschung ist, ist ein Mathematiker oder Informatiker angestellt, der im Rahmen der Auswertung experimenteller Arbeiten für mathematisch-statistische Analysen, aber auch für Korrelations- und Regressionsrechnungen, zuständig ist. Seine Leistung zu beurteilen ist schwierig, weil sein Vorgesetzter und seine Kollegen als von der Biologie her kommende Genetiker den mathematische Fundus für eine Evaluierung seiner Leistung nach qualitativen Kriterien nicht besitzen. (2) Unter einem Mangel an objektivierbaren Leistungsmerkmalen leidet sicher auch die Leistungsbeurteilung von wissenschaftlichen Dokumentaren und Informationsvermittlern, wenn deren Vorgesetzte den - in diesem Falle informationswissenschaftlichen und -technischen - Fundus nicht besitzen, der eine leistungsgerechte Beurteilung ermöglicht, wie ich selbst aus eigener leidvoller Erfahrung weiß.

Was bleibt, ist also die Zahl der Publikationen als wesentlicher Beurteilungsaspekt. Im Konkurrenzkampf um ausreichend gesicherte und dotierte wissenschaftliche Arbeitsplätze machen deshalb diejenigen Bewerber das Rennen, die gelernt haben, wissenschaftliche Publikationen oder das, was sie selbst als wissenschaftlich einstufen, "wohlformatiert, mit Proportionalschrift und Blocksatz", sozusagen am Fließband zu erzeugen.

TECHNISCHE HILFEN FÜR SCHRIFTSTELLERISCHE UND REDAKTIONELLE TÄTIGKEITEN

Mit der Reflektion über den Publikationszwang in Wissenschaft und Forschung kommen wir nun zum Kern der Ursachen für den seit einigen Jahren zu beobachtenden neuen Publikationsschub. Der Konkurrenzdruck unter den wissenschaftlich Arbeitenden und die Beschränkung der Beurteilung wissenschaftlicher Leistung auf die Publikation als matt gewordenem Spiegel des Leistungsvermögens begründen allein nicht den starken Anstieg der Informationsflut. Es sind vielmehr die vielfältigen elektronischen Hilfen des Editierens und Publizierens, die die Verbreitung von Wissen über Publikationen so erleichtern. Wir alle kennen die faszinierenden Möglichkeiten, die bereits einfache Textverarbeitungsprogramme bieten. Wie bequem ist es, mit Computerunterstützung, Texte zu editieren, zu korrigieren und zu ergänzen: Man kann z. B. ganze Sätze und Passagen überschreiben oder löschen, eigene Zusatztexte und Fremdtexte in den eigenen Text einfügen und diese nach entsprechender Modifikation voll integrieren. Man kann also diese neuen Textteile als eine Art Knetmasse behandeln und so lange verändern, bis Syntax und Schreibstil denen des eigenen Manuskriptteils harmonisch enstprechen.

Darüber hinaus sind wir heute in der Lage, umfangreiche Literaturverzeichnisse mit Computerhilfe zusammenzustellen und zu bearbeiten. Die zum Abschluß einer Arbeit genannten Literaturangaben sind ein Spiegel des Wissenshintergrundes eines Dokumentes. Sie beleuchten den wissenschaftlichen Fundus des Autors. Die Ergebnisse von Online- oder CD-ROM-Recherchen in Literaturdatenbanken werden im Download auf Diskette gespeichert, dann auf den heimischen PC oder Arbeitsplatz-PC übernommen, mit eigenen Literaturdaten gemischt und mit Hilfe einer einfachen Software so bearbeitet, daß eine sowohl inhaltlich dem Autorenmanuskript als auch formal nationalen und internationalen Normen entsprechende Literaturliste entsteht, mit einem Zeitaufwand, der nur einen Bruchteil der Zeit ausmacht, die die Älteren unter uns einsetzen mußten, z. B. für mühsames Suchen in Bibliothekskatalogen, für handschriftliches Übertragen von Titeln und bibliographischen Angaben, nachträgliches Sichten und Sortieren im Zettelkasten und für nachfolgende Reinschrift des Verzeichnisses.

Die technische Grundlage für die genannten Tätigkeiten des Autors ist eine relativ einfache und doch komfortable Textverarbeitungssoftware. Allgemein bekannt sind z. B. die Programme MS Word, Word Star, das Write-Segment von MS Windows, Word Perfect, aber auch gewisse Dateitypen des Datenbank-Mangement-Systems dBase.

Erwähnt seien hier noch die für professionelle Zwecke einsetzbaren Desk-Top-Publishing Systeme, die in Zeitungs- und Zeitschriftenredaktionen Anwendung finden und oft Text- und Bildinformationen miteinander verbinden. Als computer-gestütztes System für anspruchsvolles Publizieren in dritter Generation muß in diesem Zusammenhang noch Hypertext genannt werden. Hypertext, dessen Zielsetzung und informationstechnische Grundlagen noch keine scharfen Konturen erkennen lassen, steht dank geschickter Werbung schon heute im Rampenlicht der Publizität und wird auf informations- und kommunikationswissenschaftlichen Kongressen vorgestellt. Hier wird die Werbetrommel gerührt, ohne daß Hypertextsysteme den Praxistest bereits bestanden hätten. Anhänger und Adapten werden jedoch nicht müde zu versichern, daß die Möglichkeiten der Nutzer durch bisher nicht durchführbare "Verknüpfungen von Informationspaketen" außerordentlich erweitert würden. Die Werbung für Hypertext erwähnt auch nicht ohne Stolz die hypothetische Annahme, daß durch diese Systeme Wissen sogar neu geschaffen werden könne, also eine Art Überwissen entstünde. Daher der Name "Hyper"text.

Dieser kurze Überblick vom Stand der technischen Entwicklung elektronischen Publizierens mag als Basis für die nachfolgenden Überlegungen über die Folgen genügen. Es geht mir hier nicht darum, die unbestreitbaren Möglichkeiten und Leistungen moderner Textverarbeitung aufzuzeigen, sondern deren Auswirkungen auf die Mengenentwicklung bei wissenschaftlichen Publikationen - und damit auf den publizierenden Menschen darzustellen.

Wenn wir die Erfolge moderner Textverarbeitung für die Rationalisierung geistiger Arbeit betrachten, dann werden auch die Schattenseiten erkennbar. Es erscheint mir daher nicht nur reizvoll, sondern erforderlich, auch die negativen Aspekte einer informationstechnischen Entwicklung aufzuzeigen, die die Arbeit von Autoren und Verlegern so erleichtert hat.

AUSWIRKUNGEN AUF DEN PUBLIZIERENDEN MENSCHEN

Die positiven und negativen Wirkungen neuer technischer Entwicklungen liegen freilich eng beieinander. Das gilt auch für moderne Textverarbeitungssysteme, die sehr dazu beitragen, daß Manuskripte den letzten terminologischen und stilistischen Schliff bekommen. Die Vielfalt an Möglichkeiten, mit denen Texte mit diesen Systemen variiert werden können, mag auch solchen Autoren zugute kommen, die sich nicht ganz sicher im schriftlichen Umgang mit der eigenen Muttersprache fühlen. Es ist nämlich ein oft beobachtetes negatives Phänomen, daß die Einflüsse des Telefons und der elektronischen Unterhaltungsmedien und die damit verbundene Zurückdrängung des Briefes als Kommunikationsmittel das natürliche Sprachempfinden schwächen. Ich will nicht soweit gehen zu sagen, daß diese Entwicklung zum Entstehen eines Analphabetismus neuen Stils beigetragen hat. Doch legen Formulierungsschwierigkeiten mancher, auch wissenschaftlicher, Autoren, einen solchen Schluß nahe. Auf jeden Fall tragen aber Autoren ein erhebliches Maß an Verantwortung für einen Umgang mit der Sprache, bei dem größtmögliche Verständlichkeit, auch über den oft sehr kleinen Kreis der Spezialisten hinaus, oberstes Gebot ist. Doch elektronisches Publizieren wirft auch ethische Probleme auf, die für die moderne Informationsgesellschaft durchaus vergleichbar sind mit denen, welche die Diskussion über die Folgen der kommerziellen und vor allem militärischen Nutzung von Otto Hahns Entdeckung der Kernspaltung für die Existenz der Menschheit offenbart hat.

Worin liegen nun die negativen Aspekte elektronischer Publizier- und Editierhilfen? Es hat sich gezeigt, daß im Forschungsbereich arbeitende Autoren verschiedenen Versuchungen unterliegen können:

Mehrfachveröffentlichungen von Forschungsergebnissen

Zu den ungeschriebenen Gesetzen wissenschaftlichen Publizierens gehört es, eine Arbeit nur einmal zu veröffentlichen, auf jedenfall aber dann, wenn eine Zweitveröffentlichung ungekürzt oder gekürzt an anderer Stelle, z. B. im Rahmen wissenschaftlicher Öffentlichkeitsarbeit, unvermeidbar ist, die Quelle des Nachdruckes oder der Zusammenfassung anzugeben. Die Verwendung von Textverarbeitungssystemen ermöglicht es nun, Veröffentlichungstitel und Wortlaut einer Arbeit so abzuwandeln, daß der unmittelbare Zusammenhang mit der Originalarbeit nicht mehr oder nur noch sehr schwer erkennbar ist. Der oben geschilderte Zwang vieler Autoren zu permanentem Leistungsnachweis durch Publikationen als Maßstab wissenschaftlicher Leistung ist für manchen Autor Triebfeder, sich über die oben genannten ungeschriebenen Gesetze wissenschaftlichen Publizierens hinwegzusetzen. Zusätzlichen Anreiz für Mehrfachveröffentlichungen mag für finanziell nicht abgesicherte Autoren auch das Mehrfachkassieren von Honoraren sein.

Mehrfachveröffentlichungen werden aber oft auch von Verlegern und Redaktionen von Fachzeitschriften gefordert, die das Veröffentlichen wichtiger wissenschaftlich-technischer Informationen nicht allein der Konkurrenz überlassen wollen. Unschwer erkennbar ist z. B., daß in dem Graubereich zwischen Originalarbeit und Sekundärarbeit, insbesondere bei Publikationen über empirisch gewonnene Daten, die entsprechend kommentiert werden, Mehrfachveröffentlichungen häufig sind.

Es ist dies eine Beobachtung, die ich bei der Analyse der Literatur über Ursachen und Folgen des Waldsterbens machen konnte. Eine diese Literatur nachweisende Bibliographie mit dem Titel "Immissionen und Waldschäden" ist unter meiner Leitung für den Zeitraum von 1982 bis 1987 zusammengestellt und in der Schriftenreihe "Mitteilungen der Bundesforschungsanstalt für Forst- und Holzwirtschaft" (BFH) veröffentlicht worden. Die Zahl der in dieser Bibliographie nachgewiesenen Arbeiten zeigt nun eine stark ansteigende Tendenz: der 1983 erschienene Jahresband enthielt noch 408 Literaturhinweise aus Datenbanken, der Band 1987 enthält bereits ca. 1400 Zitate. Von diesen sind nach meiner persönlichen Einschätzung allenfalls 50 % originäre Arbeiten, die Ergebnisse neuer Forschungstätigkeiten darstellen. Der andere Teil der in dem genannten Band der Bibliographie nachgewiesenen Arbeiten entfällt auf oft "getarnte" Mehrfachveröffentlichungen, deren sekundärer Charakter nicht auf den ersten Blick erkennbar ist.

Das erwähnte, von Verlegern und Redaktionen geförderte Mehrfachveröffentlichungsproblem wird besonders sichtbar bei der Analyse von in der Regel anonymen Veröffentlichungen über die zeitliche Entwicklung des Gesundheitszustandes von Wäldern und Waldbäumen anhand empirisch erhobener statistischer Daten, die in der BR Deutschland und anderen Ländern in den jährlich erscheinenden Waldzustandsberichten (Ergebnisse der Waldschadenserhebung) zusammengefaßt werden.

Jede forstliche Fachzeitschrift hat nun den Ehrgeiz, die Erhebungsergebnisse nicht nur zu publizieren, sondern auch umfassend zu kommentieren. Die für die Waldschadensinventur zuständigen Behörden und Institutionen jedes Bundeslandes werden daher von den Redaktionen aufgefordert, ihre landesspezifischen Ergebnisse des Waldschadensberichtes darzustellen. Die technische Vorgehensweise dieser Stellen ist nun so, daß zunächst die Grunddaten nach ihrem Bekanntwerden in einer computerlesbaren Datei gespeichert werden, ebenso auch die in einem Kommentar aus den Daten zu ziehenden Schlußfolgerungen. Diese Urdatei ist dann die Basis der an die einzelnen Redaktionen zu liefernden Manuskripte, denen nun mit Hilfe moderner Textverarbeitungsprogramme ein individuelles Profil gegeben wird, indem Titel und Inhalt entsprechend variiert werden. Die Titel lauten dann z. B. "Waldschadenssituation 1988 in Baden-Württemberg" oder "Waldschadensinventur 1988 in Baden-Württemberg abgeschlossen. Etwa 60 % der Wälder weiterhin geschädigt" oder "Ergebnisse der Waldschadensinventur 1988. Stabilisierung beim Gesundheitszustand des Waldes in Baden-Württemberg".

Ganz sicher hat es diese Variation von Titeln und Texten auch schon vor dem Vorhandensein von Textverarbeitungssoftware gegeben. Die Produktion variierter Mehrfachveröffentlichungen war jedoch nicht mit der Geschwindigkeit und Perfektion möglich, mit der heute Texte druckfertig verändert und in verschiedenen Variationen, quasi simultan, in forst- und landwirtschaftlichen Fachblättern veröffentlicht werden können.

In diesem Zusammenhang sei noch erwähnt, daß Zeitschriftenredaktionen versuchen, sich die Speicher- und Variationsmöglichkeiten von Textverarbeitungssystemen dadurch zu Nutze zu machen, daß sie ihre Autoren zur Lieferung von Manuskripten auf Diskette auffordern. So fand ich z. B. in einer holzwirtschaftlichen Fachzeitschrift folgenden redaktionellen Hinweis:

"An unsere Autoren: Viele von Ihnen werden den Nutzen und den Komfort der elektronischen Datenverarbeitung auch im Bereich der Texterfassung und -bearbeitung bereits erkannt haben und Texte nicht mehr mit mechanischen und elektrischen Schreibmaschinen, sondern mit elektronischen Speicherschreibmaschinen oder Personal Computern erfassen, bearbeiten und korrigieren. Dort, wo zum Speichern der Texte MS-DOS-Disketten verwendet werden, besteht die Möglichkeit, der Redaktion zusammen mit dem ausgedruckten Manuskript auch die dazugehörige Diskette zur Verfügung zu stellen (Formatierung 360 KB bei 5,25-Zoll-Disketten bzw. 720 KB bei 3,5-Zoll-Disketten). Dies kann unter Umständen die Veröffentlichung eiliger Beiträge beschleunigen."

Obwohl dieser Text noch recht dilettantisch abgefaßt ist, sollte er doch als Versuch von Redaktionen aufgefaßt werden, an den Segnungen der Rationalisierung durch geschicktes Verändern und Ergänzen von Texten, z. B. durch Hinzufügen von Titelteilen als journalistisch gestaltete "Aufhänger", teilzuhaben. Zweifellos können sich clevere Redaktionen so auch eine Datenbasis schaffen, die jederzeit für die Erstellung eigener redaktioneller Aufsätze und Meldungen selektiert werden kann.

Integration von Fremdtexten

Mit dieser Bemerkung bin ich schon auf die Einbeziehung von Fremdtexten zu Veröffentlichungen eingegangen. Die Mitverarbeitung fremder Texte stellt eine Revolution schriftstellerischer Tätigkeit schlechthin dar. Sie erleichtert das Zitieren fremder Autoren ebenso wie die bedenkenlose Modifikation und Integration von Fremdtexten mit ihren rechtlichen Folgen im Hinblick auf den Schutz des Urhebers und den Datenschutz. Die urheberrechtlichen Folgen leichtfertigen Einbeziehens von Fremdtexten sind durchaus einleuchtend. Doch auch das Datenschutzrecht kann betroffen sein, dann, wenn personenbezogene Daten aus Briefen und anderen, teilweise vertraulichen Schriftstücken in die eigenen Texte des Autors integriert werden. Die Einbeziehung auch persönlicher und vertraulicher Mitteilungen und Texte wird in Zukunft weder ihr Abschreiben noch ihr Einlesen in den Computerspeicher mit Scannern erfordern. Voraussetzung ist lediglich eine Weiterentwicklung des Systems der Telefax-Übermittlung über die bisher übliche Ausgabe auf Thermopapier hinaus. Die schnelle Verbreitung von Telefax mit jährlich zweistelligen Zuwachsraten macht vielmehr die Entwicklung neuer rationeller Methoden des "Ablegens" und Bearbeitens der so übermittelten Schriftstücke erforderlich. Die Industrie hat dies erkannt und eine Technik entwickelt, die das direkte Einlesen solcher "gefaxten" Dokumente in den PC ermöglicht. Der Papierausdruck am Faxgerät ist dann nicht mehr erforderlich. Nachfolgend können die per Fax übermittelten Texte mit dem PC bearbeitet, sortiert und systematisch abgelegt werden. Sie sind wesentlich schneller auffindbar, als es über das Nachschlagen der Texte in einer aus dem Schrank zu holenden Akte möglich wäre. Sogenannte Vorgänge, wie sie in der Amtssprache genannt werden, werden so für jeden potentiellen Autor greifbar und damit auch bearbeitbar.

Wissenschaftliche Konsequenzen

Die Revolution in der Technik, die es Autoren möglich macht, ihre Texte komfortabel mit minimalem Zeitaufwand zu erstellen, bleibt nicht ohne Auswirkungen auf das Image des Wissenschaftlers und die Beurteilung seiner Arbeit in der Öffentlichkeit. Moderne Textverarbeitungssoftware verführt nämlich, wie wir gesehen haben, zu wissentlichen und auch unwissentlichen Plagiaten. Die wissenschaftsethischen Fragen, die ein solches gewolltes oder ungewolltes Verhalten aufwerfen, sollten deshalb nicht für gering erachtet werden. Es ist sicher kein Beruhigungskissen, wenn wir wissen, daß auch erfahrene Hüter des Copyright - dank raffinierter Tarnungsmöglichkeiten durch Word-Processing - Plagiate nur selten zu erkennen vermögen. Was aber die Öffentlichkeit eher beunruhigt als der meist unbemerkte Diebstahl geistigen Eigentums, das ist die durch moderne Textverarbeitung erzeugte Fülle wissenschaftlicher wie pseudowissenschaftlicher Publikationen, deren Vielzahl bei magerem wissenschaftlichen Inhalt die Glaubwürdigkeit der unter dem Dach der Wissenschaft publizierter "Erkenntnisse" eher untergräbt als fördert.

AUSWIRKUNGEN AUF DOKUMENTATION UND INFORMATIONSVERMITTLUNG

Und damit komme ich zu meiner abschließenden Betrachtung über die Auswirkungen dieser weitgehend technisch erzeugten Informationsflut auf Dokumentation und Informationsvermittlung als Dienst an Forschung und Lehre.

Die Konsequenzen dieser Entwicklung für die informationsvermittelnde Tätigkeit von Dokumentaren und Bibliothekaren sind durchaus gravierend. Eine Lösung des Mengenproblems mit dokumentarischen Mitteln ist leider nicht in Sicht. Lösungsvorschläge könnten nur zum Ziele haben, die mit Hilfe von Textverarbeitungssoftware produzierte Sekundärliteratur neuer Art von der Primärliteratur zu trennen, um so einen Literaturnachweis nach qualitativen Kriterien zu ermöglichen. Technische Rationalisierungsmöglichkeiten, die eine Selektion von Mehrfachpublikationen und anderer sekundärer Veröffentlichungen aus Literaturdatenbanken erleichtern würden, sind nicht erkennbar. Das vorhandene Instrumentarium für den Nachweis relevanter Veröffentlichungen reicht jedenfalls dafür nicht aus. Immer preiswerter und leistungsfähiger werdende Massenspeicher und eine Retrievalsoftware, die ständig verbessert wird, erleichtern zwar die Speicherung und Verarbeitung von Überflußdokumenten. Die technisch bedingte Informationsflut erhöht jedoch den Arbeitsaufwand gerade in dem Bereich, der für eine technische Rationalisierung wenig bis gar nicht geeignet ist, nämlich der Inhaltserfassung von Dokumenten als vornehmlich intellektueller Leistung von Menschen. Bedenkenloses Aufnehmen aller Dokumente im Massenspeicher führt außerdem dazu, daß Endbenutzer sich oft angesichts der erdrückenden Zahl der bei Online- oder CD-ROM-Suchen gefundenen Dokumente in ihrer Not, nur die lesbaren Arbeiten selektieren zu müssen, allein gelassen fühlen.

Der Nachteil des mechanischen Nachweises von Sekundärliteratur könnte nur abgeschwächt werden, wenn man aus den Listen auszuwertender Fachzeitschriften konsequent alle Titel eliminiert, die überwiegend keine originären Arbeiten publizieren. Wenn man sich dazu durchringt, muß man allerdings auch in Kauf nehmen, daß durch Nicht-Auswertung und -Erfassung der wenigen dennoch in solchen Zeitschriften enthaltenen Primärveröffentlichungen ein Informationsverlust eintritt.

Eine weitere Linderung der Probleme sehe ich in der Implementierung von Volltextdatenbanken. Die bereits erwähnten großen Massenspeicher, einschließlich CD-ROM und anderen optical discs, erlauben die Speicherung und den Abruf ganzer Zeitschriftenbände. Solche Volltextdatenbanken, wie sie z. B. in Ergänzung zum CA-file der Datenbank CAS-Online, aber in Deutschland auch vom Wirtschaftsdatenbanken anbietenden Host GENIOS der Zeitschrift "Handelsblatt" unterhalten werden, können allerdings nur wenige besonders ausgewählte Zeitschriften enthalten.

Die Aufnahme in diese Datenbanken würde von Autoren und Verlegern dieser Zeitschriften als Auszeichnung verstanden werden. Der Ausschluß von Zeitschriften aus einer Volltextdatenbank könnte andererseits deren Verleger zu strengeren Qualitätskontrollen veranlassen, um dereinst in den erlauchten Kreis der Lieferanten für Volltextdatenbanken aufgenommen zu werden. Letztlich entscheidet jedoch der Markt - und nicht zuletzt auch die Klärung der mit Volltextdatenbanken verbundenen urheberrechtlichen Probleme - darüber, ob der von mir skizzierte Weg gangbar ist.

SCHLUSSFOLGERUNGEN

Aus der Fülle der durch die Methoden des elektronischen Publizierens aufgeworfenen Fragen konnten im Rahmen dieser Analyse nur diejenigen behandelt werden, die zu der allgemein so beklagten Literaturflut beitragen. Mit der Darstellung der negativen Seiten sollte der Wert des Word-Processing nicht in Frage gestellt werden. Doch liegen auch hier - ebenso wie bei vielen anderen neuen technischen Konzeptionen - Segen und Fluch eng beieinander.

Ich wünsche mir, daß wir alle, die wir am Wissenschaftsbetrieb beteiligt sind, dazu beitragen, daß die negativen Folgen elektronischen Publiziernes möglichst klein gehalten werden.

Was wir brauchen, um dieses Ziel uneingeschränkt zu erreichen, wäre ein neuer Mensch, der Mensch der Informationsgesellschaft, der Homo sapiens informaticus, wie ihn Klaus Häfner, der Bremer Informatikprofessor genannt hat. Es wäre dies ein Mensch, der gelernt hat, mit der Informations- und Kommunikationstechnik verantwortlich so umzugehen, wie wir Menschen bereits gelernt haben, mit der elektrischen Energie oder mit dem Auto umzugehen. Doch wissen wir oft aus eigener leidvoller Erfahrung, daß auch die volle unfallfreie Beherrschbarkeit dieser leichten Techniken durch den Menschen eine Utopie ist.

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L'ETAT ET LA DEGRADATION FORESTIERE AU MAGHREB COLONIAL ET INDEPENDANT (1838-1988)

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RESUME

L'analyse des déterminants historiques de la dégradation forestière au Maghreb amène à attribuer un rôle non négligeable aux politiques mises en place à l'époque contemporaine pour y remédier. En assurant la promotion d'un modèle d'aménagement forestier qui était inadapté à la fois biologiquement et socialement, les actions forestières ont ainsi contribué à accélérer le recul quantitatif et qualitatif de la forêt d'Afrique du Nord. Lutter contre cette dégradation forestière qui se poursuit de nos jours implique dès lors de rompre radicalement avec les politiques forestières suivies jusqu'ici.

mots-clés : histoire contemporaine, administration forestière, Etat, dégradation forestière, Maghreb.

SUMMARY

The analysis of the historical causes of forest degradation in North-Africa leads to consider that one of them is due to the policies adopted since the middle of the XIXth century to fight against. While promoting forestry operations which were unadapted from both a biological and social point of view, these forest policy measures have strongly contributed to favorize this negative evolution. As to limit this forest degradation, which continues now-a-days, it is necessary to change the logic of the forest policies conducted.

keywords : present history, forest service, State, forest degradation, North-Africa.

INTRODUCTION

La dégradation des formations boisées méditerranéennes a fait l'objet, depuis en gros un siècle, de diverses études qui s'attachent toutes à souligner l'ampleur du phénomène. En l'absence d'outils permettant d'identifier et de mesurer des faits concrets et vérifiables, et en se fondant donc sur des témoignages littéraires de contemporains, on en conclut ainsi qu'au cours des siècles, les diverses utilisations qui ont été faites des espaces boisés méditerranéens les condamnent lentement mais sûrement à une sorte de disparition progressive.

Si le constat de cette dégradation n'est probablement pas erroné, les conclusions qui sont le plus souvent tirées de cette approche historique sommaire peuvent l'être. Faute d'une analyse suffisamment approfondie des déterminants sociaux et économiques de l'évolution constatée, les solutions généralement proposées pour renforcer les politiques forestières apparaissent en tout cas susceptibles d'accentuer la dite dégradation qu'elles sont censées devoir enrayer.

LES FORESTIERS ET LA COLONISATION

C'est sans doute en Algérie, c'est-à-dire là où l'intervention étatique a été la plus intense, que les incidences directes et indirectes sur la dégradation des ressources forestières se sont fait sentir le plus fortement.

D'abord, l'installation de la colonie s'est effectuée par la mise en culture de terres qui donnaient lieu jusqu'alors à une utilisation très extensive. Les terrains de plaines et de coteaux défrichés par l'armée au profit des nouveaux venus ont presque tous été gagnés sur des formations arborées généralement ouvertes, mais parfois aussi fermées, comme ce fut le cas en Kabylie ou dans le Tell. L'Etat colonial a donc détruit des forêts pour y installer ses ressortissants, et cette destruction même, dont il est significatif de constater que les statistiques ne conservent aucune trace précise, a porté sur plus de la moitié de la surface forestière défrichée dans la seconde moitié du XIXème siècle. Considérée sur le moment comme un acte positif de mise en valeur, la destruction des forêts a été encouragée, et dans un certain sens organisée, par l'Etat.

Mais l'implantation coloniale n'a pas eu d'incidences que sur les seuls terrains nouvellement mis en valeur. Elle en a eu aussi sur les terres périphériques délaissées, et sur lesquelles les populations locales se sont retrouvées *ipso facto* regroupées. Disposant là d'un espace plus limité, les tribus ont continué à y conduire des modes d'utilisation des terres très extensifs. La densité du parcours s'est alors trouvée suffisante pour générer progressivement tout un ensemble de phénomènes de dégradation forestière. C'est donc parce que les tribus indigènes se sont retrouvées refoulées par la colonisation sur des territoires plus exigus que la dégradation de ces zones marginales s'est accentuée dans la seconde moitié du XIXème siècle.

Même si cette seconde forme de destruction forestière est restée moins importante que la première, c'est pourtant contre elle que s'est organisée l'administration forestière de la colonie, fondée dès 1838 mais restée peu étoffée jusqu'à la fin du Second-Empire. Après s'être surtout occupée de délimiter les forêts de chêne-liège en vue de les concéder à des colons qui y ont conduit une exploitation très dégradante, l'ensemble du service forestier s'est surtout organisé pour conduire des opérations de police de l'utilisation de ces espaces boisés périphériques. Toutes les forêts furent classées en 1863 comme bien d'Etat, et l'administration put dès 1874 recourir à l'amende collective et au séquestre des biens des tribus, étendant même son autorité aux simples broussailles à partir de 1885. Un Code forestier algérien, qui comprenait des dispositions plus sévères que la loi forestière métropolitaine, organisa finalement en 1903 ces diverses missions policières, auxquelles avait fini par se réduire l'intervention des forestiers en Algérie.

Dans les autres colonies d'Afrique du Nord, où l'implantation française était moins importante, l'intervention réglementaire des forestiers fut sans doute plus limitée, mais elle puise dans les mêmes principes. En Tunisie, où un service forestier avait été constitué en 1886, les forestiers obtinrent en 1915 la promulgation d'une loi forestière calquée sur celle en vigueur en Algérie. Au Maroc le service forestier installé en 1913, organisa progressivement un régime forestier qui avait surtout pour objectif de contrôler les parcours. La domanialisation des forêts fut décrétée en 1916, et un code forestier en 86 articles fut promulgué en 1917. Même si les autorités firent montre d'une grande souplesse dans son application, l'activité des forestiers restait donc essentiellement absorbée par les missions de police.

L'administration forestière métropolitaine, qui revendiquait la tutelle hiérarchique des forestiers d'Afrique du Nord -restés longtemps rattachés à l'autorité militaire-, avait toujours fait de la dégradation forestière son unique cheval de bataille, poussant à un durcissement des opérations de police. Jusque vers les années 1880, les colons s'étaient beaucoup méfié de telles vélléités, susceptibles de limiter leur propre marge de manoeuvre en Algérie. Et tant qu'il avait fallu défricher pour la mise en culture et exploiter massivement les suberaies, les prétentions forestières s'étaient vues toujours contenues. Mais à la fin du siècle, devant la nécessité de se prémunir contre les incendies à la périphérie, colons et forestiers s'allièrent alors en désignant comme responsables de la dégradation forestière les tribus indigènes. Un dispositif policier se mit alors en place pour encadrer les populations locales, et à l'occasion de la réforme du statut de la colonie en 1881, le service forestier algérien fut rattaché à l'administration métropolitaine des forêts. Les conditions étaient alors réunies pour qu'une répression efficace des délits forestiers puisse être mise en place. Dès lors, l'administration forestière se trouva partie prenante d'une vaste opération de *racket* des indigènes, auxquels les séquestres imposaient un lourd tribut sous forme d'argent et de terres. Les procès-verbaux ne cessèrent de pleuvoir avec une sévérité croissante : vers la fin du XIXème siècle, le montant des amendes après transactions dépassait de beaucoup le produit des ventes des exploitations forestières. Les particuliers, tout comme l'Etat, payaient en fait leurs gardes forestiers pour faire rapporter leurs broussailles.

LA DYNAMIQUE DU FEU

Ce renforcement progressif de la police forestière au Maghreb, et notamment en Algérie, fut à l'origine d'un spectaculaire développement des incendies de forêts, lesquels parcoururent la quasi-totalité des massifs boisés pendant toute l'époque coloniale. L'origine délictuelle de ces feux, dont le développement est directement correlé avec l'intensification de la répression (par exemple insurrection kabyle de 1873, lois policières de 1881 à 1885, Code de 1903...) mais pas du tout aux conditions climatiques, ne fait aucun doute. Les statistiques précises tenues à cet égard par l'administration coloniale montrent que plus du tiers de ces incendies s'est déclaré en période humide ; les cas où la négligence ou la malveillance ne sont pas clairement établies ne représentent guère que 8% seulement du nombre de foyers allumés. Rien qu'entre 1881 et 1914, on estime à plus de 200 000 ha. la surface forestière complètement détruite de ce fait. Durant la Troisième-République, l'Algérie aurait peut-être ainsi perdu près d'un million d'ha. de forêts.

Que la délinquance forestière ait pu atteindre de telles proportions et entrainer, sous ces climats méditerranéens, de telles conséquences, ne doit pas surprendre. Il faut bien voir en effet que la réglementation forestière plaçait curieusement la majeure partie de la population de l'Algérie en état d'infraction permanente. Ses bases juridiques, déjà plus ou moins bien adaptées à la métropole, n'étaient pas compatibles avec le droit musulman qui ignorait la notion de propriété exclusive pour ne retenir que l'usage que l'on en faisait. Les tribus, à qui l'on disait que les broussailles pâturées par leurs troupeaux ne leur appartenaient pas ne comprenaient rien du tout. De plus la logique de l'exploitation était elle-même différente. Les tribus se déplaçaient en permanence : la réglementation qui leur interdisait d'établir des douars à moins de 200 m. de sols baptisés forestiers -mais qui en l'espèce étaient occupés par des broussailles- les mettaient en état d'infraction permanente. La législation métropolitaine, conçue pour faire face à une réalité sociale toute différente, n'avait ainsi guère de sens, et par conséquent de chances d'être appliquée.

Quitte à être dans l'illégalité, autant alors gérer celle-ci de telle sorte qu'elle favorise les potentialités des sols. L'incendie pouvait en effet s'avérer d'un double intérêt. D'abord, il contribuait à renforcer la cohésion de la société locale face à l'occupant, dont il manifestait l'opposition en des termes on ne peut plus clairs. Ensuite, le feu constituait le meilleur moyen de régénération des pâturages, quand il ne permettait pas d'étendre subrepticement la surface mise en culture. A cet égard, l'incendie des bois et broussailles apparait même comme la seule réponse technique pertinente à la nouvelle situation occasionnée par le refoulement des tribus dans des zones où l'intensification agricole n'était pas possible. On comprend ainsi l'importance que les incendies ont pu prendre.

Face à cette situation, la législation, dont certains voyaient déjà les limites, chercha bien à s'adapter, mais en vain. Le système de transaction avant jugement fut généralisé afin d'abaisser le montant des pénalités pour en augmenter le nombre. L'administration forestière se trouva même à plusieurs reprises débordée par l'organisation des journées de prestation de services auxquelles étaient soumis les délinquants insolvables, c'est-à-dire la majorité des paysans. On s'était résigné à ne traquer que les récidivistes, avant de s'apercevoir alors du côté systématique de ce statut. L'amende, en fait, était devenue une sorte de fiscalité aléatoire mais généralisée, à laquelle était subordonné l'accès aux ressources forestières, qu'elle ne pouvait donc nullement empêcher.

En fin de compte, la réglementation forestière avait des conséquences contraires aux objectifs qu'elle entendait poursuivre. En refoulant les tribus dans un territoire que la colonisation et le droit forestier ne cessaient de restreindre, elle conduisait du même coup à un surpâturage nuisible à la régénération forestière. Sans armes contre les dégradations des bois par les colons, les forestiers contribuaient même objectivement à la disparition des forêts parcourues par les tribus. Les solutions réglementaires choisies pour contrôler la situation accentuaient ainsi les problèmes plutôt qu'elles ne les résolvaient.

LA CONTINUITE REGLEMENTAIRE

Les indépendances n'ont nullement occasionné une rupture dans cette logique réglementaire. Formés à l'époque coloniale, les services forestiers n'ont pas changé leur fonctionnement. Mieux, une plus grande légitimité sociale des interventions publiques leur confère désormais parfois une meilleure efficacité répressive.

Sans doute les incendies sont-ils aujourd'hui moins nombreux qu'ils ne l'étaient il y a par exemple un siècle. Il existe en effet à celà de multiples raisons. D'abord les espaces boisés à brûler sont bien-sûr moins nombreux. L'hostilité envers l'administration, ensuite, ne s'exprime plus de cette façon. Enfin les espaces naturels sont aujourd'hui parcourus par un plus grand nombre de troupeaux, ce qui contribue à un meilleur entretien de la strate herbacée et partant à un meilleur contrôle des incendies.

Mais il ne faudrait pas croire que les dégradations forestières aient pour autant cessé. Car faute de modèles alternatifs de développement agricole, l'utilisation de l'espace rural est restée identique. Et la réglementation forestière, demeurée exclusive et répressive, n'est pas plus à même de jouer un rôle d'encadrement social. Dans la mesure en effet où la population locale est restée dans une situation de délinquance systématique à l'égard du Code forestier, l'application de la loi n'a pas gagné concrètement de raison d'être. Les forestiers continuent bien sans doute de dresser procès verbal sur procès verbal, mais le système politico-administratif fonctionne sur des bases différentes qui l'amènent à annuler la plus grande partie de ces décisions. D'un certain point de vue, la société locale se protège du droit forestier en développant tout un ensemble de pratiques traditionnelles qui ont fait sa cohésion à l'époque coloniale, et qui lui confèrent aujourd'hui sa grande autonomie réglementaire. Mais ce faisant, il n'existe plus aucun garde-fou permettant de réguler l'utilisation des espaces boisés, lesquels donnent lieu plus que jamais à des usages superposés et non contrôlés. Et alors que le droit forestier répressif et exclusif est devenu concrètement inapplicable, aucun dispositif ne vient plus réglementer les pratiques forestières.

Devant une telle situation, la solution qui est apparue progressivement comme la plus pertinente consiste à faire participer activement la population rurale à l'entretien des ressources forestières. La rupture logique dans la réglementation est importante, ce qui rend d'autant plus difficile cette évolution. Mais les nouvelles lois forestières promulguées au Maroc en 1976, en Algérie en 1984 et en Tunisie en 1988, attestent -en dépit de leur grande timidité- de l'intérêt qu'il y a, si l'on veut enrayer la dégradation des espaces boisés, à associer concrètement les paysans à l'élaboration et à la mise en oeuvre des dispositifs collectifs d'encadrement de l'utilisation des ressources naturelles. La définition d'un nouvel équilibre technique et socio-économique susceptible de garantir l'entretien des espaces boisés à long terme n'est certes pas chose aisée. Elle suppose en effet une meilleure adéquation entre réglements juridiques et mécanismes biologiques, lesquels restent parfois encore mal connus. Mais elle constitue sûrement aujourd'hui le principal enjeu forestier pour l'ensemble de la zone méditerranéenne.

CONCLUSION

Aussi paradoxal que celà puisse paraître, c'est donc en cherchant d'abord à faire sortir les paysans du bois que les forestiers ont probablement eux-mêmes contribué à accentuer encore la dégradation forestière qu'ils voulaient combattre. Sans doute ne l'ont-ils pas créé eux-mêmes, ce déséquilibre, dans des régions où les conditions climatiques et pédologiques sont telles que toute action humaine est porteuse de risques et d'irréversibilité. Mais l'échec patent de la logique exclusive et répressive des opérations forestières traditionnelles fournit des arguments supplémentaires à la thèse prônant la nécessité de fonder l'entretien des ressources boisées sur la participation directe de ses utilisateurs. Une nouvelle logique forestière est à inventer en Afrique du Nord, et probablement même dans l'ensemble de la zone méditerranéenne.

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13 décembre 1989

LA PRIVATISATION DES FORETS NATIONALES

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RESUME

* L'aliénation des forêts royales ne se conçoit pas sous l'Ancien Régime, le domaine étant réputé inaliénable. Ce n'est en effet qu'en se servant des peuplements sylvicoles, et non en cédant leur fonds que la monarchie peut espérer se procurer des ressources quand les caisses sont vides. Il n'en va plus de même avec la Révolution et les régimes suivants, et ce jusqu'au Second Empire inclus, c'est-à-dire jusque dans le dernier tiers du XIXe siècle. La communication montre comment a évolué la composition du domaine public forestier, à quels motifs répond sa mise en vente, ce qu'il a rapporté et quels furent les acheteurs.

* MOTS CLES : foresterie française, politique forestière, nationalisation, privatisation, morcellement.

INTRODUCTION

* Sous l'Ancien Régime, privatiser les forêts relevant du domaine royal semble chose impossible à concevoir. Celui-ci est en effet inaliénable, c'est-à-dire qu'il ne peut être démembré, dénaturé ou vendu à des particuliers pour quelque cause que ce soit, fussent-ils parents de Sa Majesté.

* Les terres et bois octroyés aux princes apanagés n'entament en rien ce principe puisque les bénéficiaires d'un tel statut, s'ils jouissent du revenu de ces biens, ne sauraient pour autant prétendre détenir les fonds. Pas d'illusion sur ce chapitre : la Couronne conserve la propriété des pays concédés et se réserve le droit de réversion quand s'éteint la postérité masculine. Cette pratique du reste, courante aux XVe et XVIe siècles, s'estompe par la suite. C'est qu'à la différence des Capétiens et des Valois, les Bourbons ne donnent guère de puînés au dauphin de France : en 1661, Philippe d'Orléans, frère de Louis XIV, en 1771 et 1773, les comtes de Provence et d'Artois, frères de Louis XVI se verront ainsi constituer un apanage. Trois donations seulement, donc, en cent cinquante ans.

* La monarchie n'émiette pas son domaine pour des histoires de famille. Pas davantage, non plus, pour des questions d'argent. Les terres

et bois engagés à ceux qui veulent bien lui avancer les sommes nécessaires à son fonctionnement servent en fait à drainer vers elle des liquidités, et non à asseoir des hypothèques. L'Etat peut faire banqueroute (1). Ses créanciers n'auront aucun gage à saisir. Les preneurs, eux-aussi, ne sont qu'usufruitiers : la gestion des biens ne passe en d'autres mains que celles des officiers royaux que le temps d'éteindre l'emprunt contracté.

* Dans le cas des apanages comme dans celui des engagements, lorsque vient à expirer le délai prévu, la jouissance cesse et l'inspection commence. Il n'est pas rare qu'à l'issue de la procédure, les abus commis donnent matière à poursuite, ne serait-ce que pour rappeler à ceux qui l'avaient oublié que le souverain n'abdique jamais la plénitude de ses prérogatives. Le domaine est et demeure un.

* Il faut dire que cette situation juridique convient tout particulièrement aux espaces boisés (2). Comment, sinon, être assuré d'un approvisionnement régulier des arsenaux maritimes ? Comment, sinon, être certain de conserver en réserve une partie du matériel ligneux ? Eduquer des peuplements sylvicoles en futaie dès cette époque s'avère un luxe que seul l'Etat peut se permettre. Les capitaux privés s'y ruineraient, dit-on. Jusqu'à ce que l'Etat, axphysié, les regarde autrement. N'y a-t-il pas là quelques ressources qui lui permettraient de faire la soudure ? Refondre le système fiscal est une belle ambition en 89. Cela ne procure pas des ressources immédiates. Et le 20 avril 1792, la France bascule dans la guerre. Les contraintes financières deviennent telles que le sacro-saint principe peut subir quelques entorses.

Section A - L'ACCLIMATATION D'UNE IDEE

* C'est le vide du Trésor public qui, en 1789, justifie le rassemblement des députés des trois ordres. La suite des événements, nul alors ne l'aurait imaginée. Il ne s'agit en ce mois de mai que d'obtenir, selon les règles constitutionnelles du royaume, le consentement de tous à une pression fiscale accrue. Depuis belle lurette, on sait que le domaine du roi, dont les forêts constituent le plus beau fleuron, est incapable de subvenir aux besoins de l'Etat. Les impôts directs et indirects, justifiés par la guerre et pérennisés en période de paix, d'"extraordinaires", deviennent donc vite le moyen ordinaire d'y pourvoir. Mal. Et d'emprunt en emprunt, arrive l'instant où cet ordinaire ne permet même plus de régler les intérêts cumulés de la dette (3).

* Il le permet d'ailleurs d'autant moins que l'annonce des Etats Généraux a suffi à le tarir. Les troubles dans les villes gênent la perception. Quant aux paysans, impossible de leur faire acquitter la taille alors qu'ils réclament la révision de son assiette. Les représentants de l'Etat, qu'ils interviennent dans la levée de l'impôt ou le maintien de l'ordre, sont doublement démobilisés : pas de zèle quand on ne sait ce qu'il adviendra de son poste, pas de zèle, non plus, lorsque l'on ne touche plus son dû depuis plusieurs mois (4). La décomposition est rapide. Tout est dit à la fin de l'année 89. La preuve ? Quand Necker, à bout d'expédients, demande à l'Assemblée de faire elle-même appel à la Nation pour obtenir quelque argent, c'est l'échec. Le 9 août, lancement d'un emprunt de 30 millions à 4,5 %. Le 27 août, lancement d'un emprunt, cette fois de 80 millions et à 5 %. Ni l'une ni l'autre des émissions ne sont couvertes.

* Comment briser l'infernale spirale de l'endettement sinon en

jettant dans ce gouffre les valeurs les plus sûres ? Jadis, on aurait inventé de nouveaux offices. Ceux qui aspirent à grimper dans l'estime sociale en auraient acquis. Idem de ceux déjà détenteurs d'offices voisins : eux ne veulent pas d'une prolifération qui déprécie la charge possédée et d'une concurrence qui amoindrit les gages. Avec un peu de chance, toute la fournée se serait vendue, apportant à l'Etat quelque répit, aux financiers qui l'ont placée, de juteux profits. Impossible dans cette fin du XVIIIe siècle de tenter l'opération. La méthode a trop servi et on ne parle que de réformes administratives. Qui achèterait avec de telles rumeurs ? Il en va de même pour les billets sur l'Epargne. D'abord, ce sera une goutte d'eau incapable d'apaiser la soif immense de l'Etat. Ensuite, il est évident que les écouler demandera un gros effort. De quoi décourager tous les relais habituels. Constat amer : morte est la confiance dans les bricolages de ce genre. Les tuyaux trop rapiécés, la machine est en panne (5). Le temps d'en fabriquer une neuve, les liquidités n'afflueront que si l'on offre à ceux qui les détiennent autre chose, autre chose de palpable, de solide, d'indiscutable. Des terres, des bâtiments, des bois, oui, ce serait différent.

* Faire payer ceux qui ne paient pas, faire mieux payer ceux qui payent déjà, voilà pour améliorer les rentrées. Rogner sur les sorties d'argent, c'est s'en prendre au superflu, et cela paraît beaucoup plus facile que d'accroître les recettes. Le train des Maisons royales, de la Cour, bien sûr, on y pense, surtout après l'éclat de Necker publiant les Comptes de la Nation (6); on pense encore plus au coût des administrations, d'autant qu'il s'agit là d'un phénomène relativement récent, lié à l'homogénéisation des structures étatiques et à leur étoffement dans toute l'étendue du royaume. Comme nul n'aime se trouver mieux encadré que par le passé, tous rêvent d'une France où l'efficacité gouvernementale ne requerrait pas la moindre courroie de transmission. Une dangereuse utopie qui va entraîner la destruction hâtive des institutions les mieux rodées.

* La pesante tutelle des Eaux et Forêts se trouve alors dans le collimateur des têtes rénovatrices : ce corps ne constitue-t-il pas en 89 une pépinière de dirigistes (7 000 agents, 12 % de la "techno-structure" de l'époque), désireux d'astreindre les parcelles privées aux normes mises en oeuvre sur celles du public, qu'elles relèvent du domaine ou des collectivités ? Les supprimer représenterait une économie appréciable : leurs gages sont réputés à tort dévorer ce que rapportent les ventes annuelles en bois (7). Eux supprimés, pourquoi ne pas vendre le patrimoine confié à leur garde ? La hausse continue du prix du bois en fait un placement attractif. Les acquéreurs ne manqueront donc pas. Ils veilleront à ce que leur nouvel investissement produise à l'instar de leurs autres héritages. Les rendements ligneux ne devraient donc pas être affectés par ce transfert de propriété, tout au contraire.

* Bref, dans la tourmente politique qui s'abat sur une France médusée, il devient du dernier cri de vouloir privatiser les forêts royales, en faire de même des bois communaux et ecclésiastiques et aligner le statut des biens forestiers sur celui de tout autre type de propriété (8). On veut en finir une bonne fois pour toutes avec l'hypertrophie domaniale qui régit la conception administrative. Ce n'est pas que les forêts royales représentent la majorité des superficies boisées - elles en occupent le dixième - mais, depuis la réforme colbertienne de 1669, il est clair que tout le système de gestion et de protection fonctionne à leur profit. Cela se concevait au milieu du XVIIe siècle, pas un siècle plus tard. Rejetter un tel favoritisme pour traiter sur un pied d'égalité tous

les peuplements sylvicoles va évidemment dans le sens du progrès. En conclure qu'il ne faut plus évoquer la spécificité sylvicole si l'on ne veut plus des tribunaux d'exception qu'étaient les Maîtrises des Eaux et Forêts mène par contre vers de dangereux dérapages. C'est jetter l'enfant avec l'eau du bain.

Section B - LE PASSAGE A L'ACTE

* Pour l'heure, personne ne s'interroge sur ce qu'il adviendra de forêts et de bois gérés, non à long terme, mais avec la perspective d'un profit immédiat. Un taillis sous futaie ne se récolte pas comme un champ de céréales, ne serait-ce que pour l'unique raison que les conditions de reconstitution sont radicalement différentes, autonome et lente dans un cas, artificielle et annuelle dans l'autre. La question culturale indiffére. La solution financière en revanche obsède. Du coup, on ne réfléchit pas sur la manière dont réagira le marché devant l'ampleur de l'offre. Et pourtant, c'est du niveau des prix et des modalités de paiement que dépend la réussite de l'objectif. On verra plus tard. Les événements pressent. Le roi envoie sa vaisselle à la Monnaie. Le 20 septembre, les particuliers sont invités à en faire autant. Le 29 septembre, c'est le tour de l'argenterie qui n'est pas nécessaire "pour la décence du culte". Après ça, les grands moyens.

* La politique aide à prendre de telles décisions. Le domaine change en fait de nature - et de volume. Le décret du 2 novembre 1789, voté par 568 voix contre 346, place tous les biens du Clergé à la disposition de la nation. Le décret du 19 décembre établit une Caisse de l'extraordinaire, alimentée essentiellement par la vente de ces biens. Lesquels serviront de gage pour l'émission des billets - les fameux assignats -, véritables bons du Trésor, portant intérêt à 5 %, remboursables, non en espèces, mais en biens-fonds (9). A mesure que se vendront les biens, donc que rentreront les assignats, ceux-ci seront détruits pour éteindre progressivement la dette publique. Grosse coupure de 1 000 livres et créance de l'Etat, il est clair que l'assignat ne peut trouver facilement preneur et n'est pas fait pour circuler, ce qui l'empêche de répondre aux exigences du commerce. Les affaires ne repartent pas et le chômage grandit. Et le domaine là-dedans ? Distinction subtile entre ce qui relève du patrimoine des Bourbons et ce qui appartient à la Couronne de France : le roi peut se réserver la jouissance de certaines forêts et châteaux mais les biens de la Couronne iront, eux, rejoindre ceux du Clergé pour épurer la situation financière. On évalue à 400 millions la première tranche qui devra être sacrifiée à l'urgence du moment.

* L'opération tarde cependant à démarrer puisque le Clergé garde encore l'administration de ses biens et que la réforme écclésiastique n'est pas adoptée. Les deux obstacles sont levés le 20 avril et le 12 juillet 1790. Les modalités de la vente des biens nationaux sont précisées dans l'intervalle, le 14 mai. Reste à sélectionner, à estimer les biens, à organiser la publicité de la vente et le déroulement des adjudications (10). Or, pendant ce temps, ledéficit du Trésor ne cesse de se creuser. Aussi la Constituante est-elle amenée à prendre une série de mesures de circonstances, au terme desquelles l'assignat-bon du Trésor apparaîtra en assignat-papier-monnaie ne portant plus intérêt et ayant pouvoir libératoire illimité. C'est chose faite le 6 mai 1791 : il existe alors des petites (5 livres) et des moyennes (50 livres) coupures et la masse des

billets atteint les 1 200 millions. L'entreprise n'avait été montée que pour liquider la dette. Elle sert à boucher les trous du budget. On a perdu de vue la cible mais on tire avec la même arme.

* Par la vente de tous ces biens, devenus "nationaux", la Révolution s'achemine vers une nouvelle répartition de la richesse foncière qui accentue ses caractéristiques sociales. L'agitation rurale avait beaucoup contribué à paralyser les pouvoirs publics et, par conséquent, au triomphe des députés. Elle rapporte peu cependant à la classe paysanne, hormis aux laboureurs déjà propriétaires et gros fermiers. Il n'y a pas en effet de réforme agraire entraînant une multiplication des petits possédants. Il aurait fallu pour cela diviser les biens nationaux en très petits lots et accorder des facilités de paiement. C'est le contraire qui prévaut dans la loi du 14 mai 1790 : vente par exploitation, avec maintien des baux, en bloc, les enchères se déroulant au chef-lieu de canton. Toujours la volonté de hâter le mouvement ! Bons bourgeois et coqs de village sont à même de tirer parti de l'opportunité (11). Les mal nantis demeureront ce qu'ils sont.

Section C - LE POIDS DES REALITES

* Entre les beaux esprits de 1789 et les députés de la Constituante existe cependant un hiatus considérable : celui qu'engendrent les réalités du pouvoir. L'unanimité, possible dans l'univers utopique, ne l'est plus. Apparaissent alors fissures et divergences. Celles-ci sont patentes dès les débuts de la Législative, réunie pour la première fois le 1er octobre 91. Ses membres sont par définition des hommes nouveaux ((les Constituants s'étaient déclarés inéligibles par décret du 16 mai 1791) et entendent obtenir des renseignements complémentaires. D'où le recours à des experts, souvent choisis par la commission ad hoc parmi les anciens dignitaires de l'administration des Eaux et Forêts, faute de savoir à qui d'autre s'adresser (12).

* Les résultats de cette consultation étonnent. Dans le rapport Cheron-La Bruyère, on évoque l'éventualité d'une aliénation totale. Les caisses sont vides et l'argument porte davantage que les propos lénifiants sur la supériorité de la gestion privée par rapport à l'étatique et l'intérêt d'un plus grand nombre de propriétaires pour protéger un patrimoine fragile. En face de ce libéralisme radical, se développe un libéralisme plus nuancé. Parmi ses chantres, Varenne de fenille qui accepte la vente de tous les taillis non convertibles en futaie, Tellès d'Acosta qui entend supprimer tous les bois communaux, Rougier-Labergerie qui souhaite préserver tous les massifs excédant 1 500 hectares et les futaies au-delà de 60 ans. Une constante, donc, se dégage de ces débats : l'Etat a seul la faculté de conduire à leur terme les futaies, les particuliers ne pouvant en général attendre trois, quatre, cinq générations avant de procéder à la coupe. On peut planter pour son fils, à la rigueur, pour le petit-fils. On s'imagine être encore là lors de la récolte. Au-delà de cette proche descendance, commence l'incertitude et, avec elle, l'envie féroce, de gagner le plus en investissant le moins.

* Ces dissonances expliquent que tous les textes réglant l'adjudication des biens nationaux en exceptent les forêts domaniales importantes (13). Le décret du 23 août 1790, par exemple, ne livre aux acquéreurs que des lambeaux de moins de 50 hectares, distants d'au moins deux kilomètres des grands massifs. Cette mesure reste donc dans la droite

ligne de ce qui se faisait vingt ans auparavant : regroupement des zones forestières et abandon des enclaves. Incontestablement, elle bloque la privatisation du domaine, celle-ci ne s'exercant plus qu'aux dépens des forêts ecclésiastiques et, également mais à un moindre degré, de celle des émigrés.

* C'est que les dispositions visant ceux déclarés traîtres à la patrie pour ne pas y être revenus (ou en être partis) après le 20 avril 1792, date de l'entrée en guerre, ne s'appliquent pas très aisément. Tout dépend en effet des actes passés sous seing privé avant leur départ, du lieu de leur destination (prendre les eaux en Suisse et respirer l'air des Amériques demeurent autorisés) et des sympathies qu'inspire la famille restée sur place, sans compter du jeu des chargés d'affaire où interfèrent dévouement et cupidité. Il ne faut donc pas dramatiser pour l'avenir des aristocrates la portée des décrets du 27 juillet et du 14 aôut 1792, ordonnant la saisie de leurs propriétés et la mise en vente : les droits d'un enfant mineur sont reconnus et suffisent à enrayer toute la procédure de confiscation. La privatisation des forêts déclarées nationales ne s'effectue pas aux dépens des particuliers au profit de la société, mais au détriment d'une collectivité, celle du premier ordre du royaume, pour le plus grand bénéfice d'une classe, la bourgeoisie. Napoléon n'est pas encore sacré Empereur qu'il est devenu à la mode de chasser à courre dans les bois récemment acquis (14). La Révolution a ainsi permis à certains de concrétiser un vieux rêve : imiter le seigneur du crû.

Section D - LA PERMANENCE DES TENTATIONS

* Les biens nationaux vendus sont donc avant tout d'origine ecclésiastique, assez peu d'origine nobiliaire et très peu d'origine domaniale au sens strict (et ancien). Ce n'est pas tant une question de choix que de circonstance. Le constat ne témoigne pas des volontés conservatrices des autorités. Il reflète la présence de vastes étendues boisées (plus d'un million d'hectares) relevant du droit public et ne devant être ni morcellées ni défrichées.

* Rien ne garantit que cette situation se prolongera. Même un gouvernement bien intentionné peut avoir des tentations quand il ne sait plus comment payer ses troupes. Le décret du 2 nivôse an IV relève par exemple de cet état d'esprit. Il autorise le lotissement des bois n'excédant pas cent cinquante hectares, à condition toutefois qu'ils soient situés à plus d'un kilomètre des périmètres protégés. La zone frontière se resserre alors dangereusement autour des forêts domaniales et la division par lots encourage des enchères qui se traînaient jusque-là, faute de candidats pour régler au comptant de trop vastes surfaces. Toujours dans cette optique - renflouer le Trésor - le Directoire s'octroie également la faculté d'affermer pour trente ans Fontainebleau et Compiègne, déjà fort malmenées par les coupes extraordinaires décidées en l'an II. La différence n'est pas grande, qui sépare cette pratique de celle des engagements sous l'Ancien Régime.

* Il est vrai que durant toute la période révolutionnaire les affermages de forêts l'ont très largement emporté en revenu sur la privatisation. Bon nombre de bois domaniaux mis en adjudication ne trouvent pas en effet preneurs (15). Certes, leur superficie en dissuade plus d'un qui aurait sinon placé de l'argent dans "l'or vert", sachant que le prix n'est pas prêt de baisser, surtout dans ces temps guerriers : le bois

d'alors est le pétrole et le plastique d'aujourd'hui, combustible et matériau à la fois. Egalement, l'incertitude quant aux lendemains politiques réserve la participation à ces ventes aux gens qui savent (et osent) parier. De la fortune et de la hardiesse : les candidats offrant ces deux qualités n'abondent pas sur le marché. Aussi faut-il attendre le retour au calme et la consolidation des richesses pour que la privatisation des forêts nationales devienne véritablement réalisable.

* La plupart de ces forêts sont en effet grevées de droits d'usage, lesquels amoindrissent considérablement ce qu'elles sont susceptibles de rapporter. Réduire autoritairement ces prélevements en nature conditionne donc leur mise en adjudication. Qui aurait l'idée d'acquérir un bien dont l'essentiel de la récolte lui échapperait ? Personne. La difficulté est de réussir cet énergique dépoussiérage. Il était vain de compter pour cette besogne sur la Révolution et sur l'Empire. La première avait déjà sur les bras une guerre étrangère et une guerre civile : elle ne pouvait s'offrir en prime une guerre paysanne. Quant à l'Empire, la conscription suffisait : aller au-delà, c'était risquer de perdre l'appui des campagnes, bienheureuses de voir résolu le problème religieux. La privatisation ne saurait être leur fait. L'un et l'autre l'envisagent, en tâtent mais ne vont pas au bout du projet. Il faut attendre pour qu'elle passe à la vitesse supérieure le retour des Bourbons. C'est que la Restauration, elle, doit régler la facture des précédents, indemnité de guerre, frais d'occupation et milliard aux émigrés inclus. L'addition est très, très lourde (16).

* La Constituante avait eu une idée. Le baron Louis, ministre de Louis XVIII la fait sienne, le 20 juillet 1814 lorsqu'il propose d'émettre des obligations portant un intérêt de 8 %. Elles seront remboursées en trois ans sur le produit de 300 000 hectares vendus. Les forêts de l'Etat alimenteront ainsi une caisse destinée à éponger la dette. Bref, on réchauffe un potage plus d'une fois servi en période de famine budgétaire. Devant un trou de 1,3 milliard de francs les convives s'en voudraient de jouer les fines bouches. Le vote de la Chambre introuvable est donc acquis sans que rien ne soit dit sur ce nouvel accroc au principe d'inaliénabilité. Les effets s'avèrent pourtant limités. En deux ans, moins de 42 000 hectares sortent du domaine, sept fois moins que ce qu'autorisait la loi. Et les sommes rentrées ne couvrent pas 3 % du montant de la dette. Pour continuer - le gouvernement veut mettre sur le marché 100 000 hectares supplémentaires ! - il faut prendre le problème à la base, purger le domaine de ce qui éloignent les acheteurs : les droits d'usage.

* Débarrasser les forêts domaniales de "ces dévorantes servitudes", selon l'expression de Martignac se révèle difficile. Les communautés villageoises, principales intéressées, ont la sensation d'être dépouillées et luttent pied à pied dans un maquis procédurier où les uns exhibent les actes de l'Ancien Régime tandis que d'autres s'abritent derrière les papiers révolutionnaires. Entre la réaction féodale des années 1770 et le texte du 28 août 1792 si favorable aux usagers, on a tant et tant signé de documents que les hommes de loi sont assurés de bien gagner leur vie, vu la floraison de procès en reconnaissance ou déboutement de propriété que connaît le premier tiers du XIXe siècle.

* La loi sur les cantonnements du 8 mai 1827 leur facilite cependant grandement la tâche : en trente ans, de 1827 à 1857, les trois quarts des forêts domaniales - les plus rentables, c'est-à-dire en plaine - sont en mesure d'être livrées aux feux des enchères. Reste le dernier carré, soit 319 600 hectares, tous en zone sensible, là où l'agro-pastoral

rend l'opération particulièrement délicate (17). Prudence donc des autorités : la révolte des Demoiselles dans le Couserans débute en 1827 et, du coup, on n'essaie pas de dégrever les quelques 100 000 hectares domaniaux en Pyrénées avant la seconde moitié du XIXe siècle, quand l'exode rural aura bien amoindri les passions.

* On ne se gêne plus alors pour dire à voix haute que Forcade-La Roquette, qui sera directeur général des Forêts de 1857 à 1859 (sa récompense, d'après les méchantes langues) n'a "voulu dégrever les forêts domaniales de toute servitude étrangère qu'afin d'être mieux à même de leur appliquer ensuite le fameux projet d'aliénation, caressé par le ministre des Finances, M. Fould" (18). L'extension de la propriété privée qu'il envisage remet une fois de plus en cause l'inaliénabilité domaniale. La constitution d'une propriété communale par le biais des cantonnements, elle, ne posait problème qu'au Trésor public puisqu'il s'agit d'un acte par lequel l'Etat (cela vaut pour tout autre propriétaire) abandonne une portion en nue propriété aux usagers pour que le restant soit libéré de leur pression (19). Le premier cas se conçoit si les capitaux privés y trouvent profit. Le second n'est toléré par les populations que s'il ne menace pas le pastoralisme.

* Les servitudes usagères protègent donc, par un détour inattendu, la propriété domaniale au moment où l'Etat ne le désire pas. Une forêt ne se vend que si elle en est libérée et si le propriétaire est libre d'en user et d'en abuser. Que dans le cahier des charges figure une clause restreignant le défrichement rend quasiment impossible le dépassement du prix de réserve. Etrange situation, en vérité, car, au fond, jusque dans les années 1850, il n'est aucun avantage pour les nouveaux propriétaires de se comporter de la sorte : un hectare de forêt est d'un très bon rapport et peu le sont devenus pour arracher les arbres et semer du grain. Décidément, tout se fait à contre-temps dans cette entreprise engagée par nécessité et avortée par circonstance.

CONCLUSION

* Entre 1814 et 1870, 352 000 hectares de forêts domaniales quittent le giron de l'Etat, un transfert qui concerne tout de même près du quart du patrimoine public. La Restauration, avec 46 %, puis la Monarchie de Juillet, avec 33 %, exécutent l'essentiel du programme. Cette privatisation continue pourtant sous le Second Empire mais se ralentit (21 %). La majorité des acquisitions faites à cette époque par des particuliers (58 %, soit 72 000 hectares) s'inscrit d'ailleurs dans la décennie 1852-1861, et notamment dans les toutes premières années du règne. C'est donc davantage le prix à payer des désordres antérieurs que la volonté du Prince-Président.

* A partir de ces années 1850, les prix, oscillant entre 760 et 830 francs l'hectare, déçoivent. Ils décrochent nettement de ceux recueillis pendant les vingt années précédentes où il n'était pas rare de voir crevé le plafond des 1 200 francs, la barre des 1 000 francs étant régulièrement atteinte. . Saturation du marché ? Ceux qui voulaient une propriété de prestige l'ont. Tarissement du filon, aussi. Le Roi-Charbon est en passe de conquérir l'industrie française. Les bois invendus depuis 1850 sont remplacés par d'autres, plus "attractifs". Malgré ce qualificatif, la moyenne ne dépasse pas 200 francs à l'hectare. Avec cette substitution, le montant escompté devait être de 15 millions de francs. Le Trésor public n'en touche pas la moitié. Ce n'est plus la peine d'insister.

Le veau d'or a quitté les bois et il va falloir en découvrir d'autres.

* Le XIXe siècle qui tire sans complexe des chèques sur la banque verte n'y renonce qu' à la faveur de la crise forestière. Certes, il n'a pas vendu autant qu'il aurait pu, ni tout ce qu'il voulait, ni comme il le voulait. Il n'empêche que durant près de cinquante ans les forêts de l'Etat ont servi de bouche-trou financier à chaque régime, et que, des régimes, la France en a expérimenté beaucoup. Fragilité extrême du principe d'inaliénabilité !

* L'Etat détient aujourd'hui près de 13 % du total forestier, avec 1,7 millions d'hectares. Voilà deux siècles,, avant que ne s'amorce la privatisation, le Comité des Domaines à la Constituante évaluait les forêts nationales, Etat, Couronne et apanages inclus, à 1 704 000 hectares, superficie portée cinq ans plus tard à 2 592 000 hectares par le biais des confiscations. C'est dire qu'il a reconquis les positions perdues durant la première moitié du XIXe siècle. Reconquis ? Pas tout à fait car s'il y a compensatio, c'est par la constitution d'un vaste domaine en altitude, cherchant, non le rendement ligneux à l'hectare mais la protection des sols. Le balancier repart dans l'autre sens. Au nom de la restauration des terrains de montagne, premier cheval de bataille dans la défense de l'environnement, on ne parle plus de privatiser mais de nationaliser. Les temps changent...

NOTES

1 / Cela lui est arrivé plus d'une fois,notamment quant il lui a fallu éponger à la fois le coût de la guerre de Trente Ans et de la guerre civile qu'est la Fronde. La Chambre de Justice en est le déguisement en spoliant purement et simplement ceux qui ont des créances sur l'Etat (Cf. D. DESSERT, Argent, Pouvoir et Société au Grand Siècle, Paris, 1984, p. 259 et suivantes).

2 / Cf. L. PERTHUIS, Traité de l'aménagement et de la restauration des bois et forêts de la France, Paris, an XI-1803, p. 265.

3 / Le Compte du Trésor de 1788 évalue les dépenses à 630 millions de livres, 503 millions de livres pour les recettes. Rien que pour cette année là, le dépassement est de 20 % ! S'y ajoute l'endettement. Le service de la dette absorbe 318 millions, soit plus de 50 % des rentrées. Le montant de la dette atteint alors 5 milliards. Elle a triplé sous le règne de Louis XVI, en partie à cause de la guerre d'Amérique : un coût de 2 milliards couvert par l'emprunt...

4 / Les décrets des 7 novembre 90, 14 novembre et 11 décembre de la même année demandent aux officiers de contrôler encore tout abus. Pourtant, dans plus d'une maîtrise,comme dans celle de Sézanne, ils décident "la suspension desdites visites et perquisitions". Il est vrai qu'ils ont "éprouvé des refus, des résistances", mais surtoutqu'ils ne touchent plus rien. Les plus chanceux ne recevont quelque avance ... qu'en 1792, trois ans plus tard ! (Arch. nat., D XXIX bis, n° 3, 10 janvier 1790).

5 / La grande Peur de l'été 89 n'y contribue pas qu'un peu. Les campagnes sont en effervescence dans la crainte de voir se perdre les récoltes. les villes, craignant l'arrivée en masse des paysans, se cadenassent. Voir par exemple l'affolement des Grenoblois, apprenant qu'il leur fallait "se méfier des habitants des villages de la plaine quidevoient venir piller le lendemain" (Arch. nat.,D XXIX bis, n° 1, 31 août 1789).

6 / On découvre ainsi que la Cour et les privilégiés dévorent 6 % des recettes par an, en dépit des coupes sombres faites en 87 dans le bud get de la Maison du roi.

7 / TELLES d'ACOSTA, Projet de réforme et plan (d'une nouvelle administrationdes forêts et bois du Roi; F.P. FLEURY, Considérations sur l'intérêt qu'a la gouvernement de maintenir une administration forestière spéciale. A l'énoncé des titres, on voit que les administrateurs forestiers n'entendent pas se laisser supprimer sans combattre.

8 / Assemblée nationale, Opinion de M. Rougier-Labergerie sur l'aliénation etl'administration des forêts nationales, Paris, Imprimerie nationale, 1791, 24 p.

9 / La rapidité conditionnait laréussite decette opération. On ne voit pas comment cela aurait été possible alors qu'il fallait mettre en vente pour 400 millions de biens d'église ! La dépréciation était inévitable. A moins de mettre à ces billets une clause nominative et d'empêcher leur circulation.

10 / Les conseils généraux tentent souvent de retarder la vente des bois domaniaux, surtout lorsque ceux-ci participent à l'économie du département (Meuse, Moselle, Vosges). Cf. par exemple Ne vendez pas nos forêts, publié à Epinal par l'éditeur Vautrin en 1792. Cette attitude se retrouve lorsque dans le premier tiers du XIXe siècle on entreprend de les dégrever des servitudes usagères. Les conseils flairent qu'il s'agit là d'uneopération annoncant peut-être une mise en vente.

11 / A. CORVOL, L'Homme aux Bois, Paris, 1987, p. 61 et suivantes.

12 / Rappelons qu'il faudra attendre le 16 nivôse an IX pour retrouver une hiérarchie administrative et autonome. Jusqu'à cette date, les officiers forestiers - quand ils ne sont ni émigrés, ni limogés, oeuvrent par commission. En dehors des grandes forêts de la périphérie parisienne, l'administration se fait très, très discrète.

13 / A. DUBOIS-BELLEGARDE, Quelques Idées sur les forêts et bois nationaux, Paris, an VIII, 16 p.

14 / L'acquisition d'un domaine forestier couronne l'ascension sociale commencée dans les années 90. On ne s'étonnera pas que ce soit avec la Restauration que le rythme des achats s'accélère. En Côte-d'Or, par exemple, 33 % de l'offre domaniale sont absorbés par eux sous la Restauration, 57 % sous la Monarchie de Juillet, 52 % sous l'Empire. Ils profitent donc à partir des années 40 du fait que les propriétaires d'usines à feu (hauts fourneaux, verreries, faïenceries, etc) s'étant

constitué un patrimoine boisé pour réduire leur facture énergétique, cessent alors d'enacquérir.

15 / Ainsi, pour les forêts de Lozère, non degrevées, ne trouvent preneur ni en 1814, ni en 1817, ni en 1833. Ce n'est qu'une fois le cantonnement des droits d'usage en cours (il sera achevé au printemps 53), qu'elles se vendent enfin (décembre 53, soit huit mois plus tard !

16 / Le déficit est déjà de 1,3 milliards à la veille des Cent Jours. On imagine le gouffre lorsque Louis XVIII revient dans les fourgons de l'étranger pendant que le Bonaparte est expédié à l'île d'Elbe !

17 / Le XVIIIe siècle avait connu destroubles comparables en plaine dans la France septentrionale à propos de la fixationdu quart de réserve dans les bois communaux. Au XIXe siècle, c'est la France du Sud, surtout sur les hautes terres qui connaît des vagues séditieuses, liées, elles, à l'arrivée de nouveaux propriétaires, plus exigeants, et à l'affaire du dégrèvement usager.

18 / Ce n'est pas tout à fait vrai en ce sens que les opérations de dégrèvement ont commencé bien avant l'arrivée de Fould. Il est vrai qu'elles s'accélèrent enfin.

19 / Sous l'Ancien Régime, il existe deux types de procédure permettant d'obtenir ce résultat. Le triage et le cantonnement, le premier servant beaucoup moins que l'autre car fort peu avantageux pour le seigneur (il ne garde en nue propriété que le tiers des bois et ne reçoit plus aucune redevance) Cf. sur ces questions juridiques, A. CORVOL, L'Homme et l'Arbre sous l'Ancien Régime, Paris, 1984, p. 553 et suivantes.

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THE "AMERICAN COMMUNITY" AT THE CHAUDIERE: AN APPRAISAL OF THE SAWMILL INDUSTRY IN OTTAWA-HULL, 1851 - 1870

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The decade of the 1850's witnessed an impressive migration of business enterprise into the Ottawa Valley. That migration was the basis of the sawmilling industry which was to set the pace of economic and social development in the valley through-out the latter half of the 19th century. The centre of this industry was at the Chaudiere Falls, in the heart of what is now the capital of Canada, Ottawa, and its neighbour, Hull, Quebec. This paper is a preliminary analysis of the reasons behind that migration and the particular talents and advantages which these entrepreneurs brought to the situation which enabled them to establish by 1870 a major industrial centre which played an important role in the Canadian economy. The emphasis here is on one firm, the Harris and Bronson Company, but the evidence from the fine collection of business papers left by this company does, I believe, serve as an excellent base from which to begin a reappraisal of the early sawmilling industry in sawmilling industry in the Ottawa Valley.[1]

In 1871 the Ottawa - Hull area had eight large sawmills each representing fixed assets of over $100,000 and floating capital of $200,000 or more. These and a number of smaller establishments employed around 2500 men and cut 250 million board feet of lumber annually. These were large operations by any standard for Canada in the 1870's and the mills were the most important factor in the area's development up to 1910.[2] This growth of Ottawa - Hull as an industrial centre is not surprising since this urban area was located at the heart of a river valley which encompassed one of the largest and most accessible pineries in eastern North America, at a time when pine was the king of construction materials throughout the world. Also favoured by excellent waterpower sites, the area was a natural location for sawmills and finishing factories. Yet these large, capital intensive, mechanized factories did not spring up over-night. They were stimulated by the steady expansion of an export trade in sawn lumber products to American markets after 1850 and only through major entrepreneurial efforts based on sawmilling technology were these businessmen able to emerge as the economically and politically powerful "Lumber Barons" of the late 1860's.

Professor John Taylor,the most recent scholar to study this formative period in the history of the City of Ottawa, contends that the economic and professional elite of this city reflected during the 1850's and 1860's few of the ideas and ambitions usually associated with a burgeoning metropolis.[3] Most particularly there was little effective effort to control the transportation routes for exporting forest products and importing goods to supply the forest industries.Indeed, Prof. Taylor contends that there appears to have been little effort by the new sawn lumber operators, men who would later dominate their industry and local and provincial politics, to enter into organizations or associations which would allow them to influence the city's growth and development. Rather, and here I am somewhat extrapolating Prof. Taylor, Ottawa remained a service and growing industrial centre, dominated by outside financial institutions and transportation companies but saddled with a rapidly deteriorating forest resource on which to base its industrial growth.

While agreeing with Prof.Taylor concerning the failure of Ottawa as a metropolis, it would appear that he sells the "Lumber Barons" a little short. After all, sawmilling did permit the development of a sizeable industrial urban area which vied with Hamilton for second place in Ontario, especially when the later endeavours of E. B. Eddy and J. R. Booth in pulp and paper and wood by-products are taken into account. A creative and wealthy group of entrepreneurs promoted their own railway, the Canada Atlantic; set up their own bank, the Bank of Ottawa; and continued to employ new technology, particularly water-power and hydro-electric power to underwrite expanded industrial growth. Ultimately these initiatives would fail for a host of reasons and the industrial side of Ottawa declined rapidly after World War I. But these reasons would not appear to be related in any significant way to the nature of the entrepreneurship involved and, therefore, it is appropriate to reassess the advent of the sawmilling industry in Ottawa - Hull. which, it can be argued, was on the forefront of industrial technology before 1870, and to make some preliminary suggestions about the long and difficult process required of the "Lumber Barons" to integrate themselves into the economic and political structure of pre-Confederation Canada.

The events leading up to the establishment of a major sawmilling industry in the vicinity of Ottawa are fairly well-known. A number of small mills grew up to serve local demand, a demand which was definitely stimulated by construction of the Rideau Canal. These were accompanied by larger ventures which sawed deals for export to Great Britain.[4] This latter activity was the business the Hamilton firm was in at Hawkesbury from an early date and, during the 1840's, a time of boom and bust for the Ottawa Valley timber trade as a whole, enough scarce capital was found to start up a number of new deal mills.[5] Too little attention has been paid to the role of deals in the British North American timber trade and it is sometimes difficult to distinguish between the local mills and those larger ventures cutting for the export market. Of special note, however, was the mill built by the Blasdells, Julius Caesar and Nathaniel, in late 1841 at Chelsea Falls on the Gatineau River, apparently with the financial backing of the Gilmour Company, a subsidiary of the Scottish timber firm of Pollock and Gilmour, which took over the mill later in the decade, and the large deal mill built by the square timber king John Egan at Quyon on the Lower Canadian (Quebec) side of the Ottawa River in 1848.[6]

Deal production was, however, an integral part of the Canadian trade in timber to Great Britain and was subjected to the same difficulties as that larger activity. The trade was effected by the successive reductions of the British preference on colonial wood from 1842 to 1851. The most severe crisis came in the period 1849-51, when the fear that the Mother Country had abandoned the colonies led to panic, glutted markets, mill closings and not a few bankruptcies. At the same time, the reductions in duties quickened the pace of structural consolidation in the trade. Deal production slipped into the hands of the Hamiltons, Gilmours and John Egan, all of whom hand firm connections to timber and financial houses in Montreal,Quebec City and Britain. After 1849, square timber making and deal production became a specialized trade oriented to finding a small but cozy niche in the rapidly growing British timber market. Geared to meeting exacting standards overseas, the deal manufacturers had, in most cases, neither the appropriate technology or entrepreneurial inclination to push for major industrial expansion into new markets. Some, like the Gilmour Company, would make the transition into the North American market but most would not.

Thus the ending of the British preference on timber left the small urban centre of Bytown (present day Ottawa), which had depended so heavily on the British trade for its prosperity, in an angry quandary.Statistics for 1851 indicate a production of about 3 million board feet for the Bytown area, not a large quantity by Canadian standards of the time, especially since no distinguishing factor is made for deals.[7] The economic crisis of 1849 led directly to a political crisis where the economic elite in Upper and Lower Canada momentarily became enamoured of annexation to the United States. Bytown was no exception and sentiment there fed on early promise of supplying the rapidly growing American market for sawn timber. Supplies of timber in the northeastern United States were coming under increasing pressure and slowly and tentatively from about 1835 Americans began to turn to the Canadas for lumber products, despite high tariffs of about 30%. This demand accelerated during the 1840's, developing first along the shore of the Great Lakes but eventually penetrating the Ottawa Valley, where a residual leavening of early Yankee settlers added to the natural inclination to seek out new markets in the face of economic difficulties in the late 1840's.

In 1848, Thomas MacKay, the Scottish mason who had prospered in contracting for the Rideau Canal and established a settlement in the current Ottawa community of New Edinburgh, joined with his son-in-law, John Mackinnon, to replace an older mill at Rideau Falls (where the Rideau River joins the Ottawa) with a larger facility designed to provide rough sawn lumber for the northeastern U.S.[8] Moss Kent Dickinson, another Rideau River lumberman who would serve as mayor of Bytown between 1864 and 1866, is credited with shipping the first barge loads of lumber from the area to the Boston market in 1850. It is interesting that no Canadian shippers could be located for this cargo and

American boats came up the Lake Champlain route to pick it up. Dickinson, himself, would make his money in forwarding lumber and Boston interests immediately proposed to tap the area with a railway.[9]

It was the MacKay interests in New Edinburgh, however, who showed their savvy of the new possibilities by promoting the Bytown and Prescott (afterwards the St. Lawrence and Ottawa Railway) as a first, if not particularly successful, attempt to bind the Ottawa Valley to its new market area. Financed by various individuals and municipalities in eastern Upper Canada, the terminus in Bytown naturally serviced the MacKay mills. The railway was dreadfully under-capitalized but was an early effort by Ottawa Valley entrepreneurs to control access to potential markets.[10] As the following letter from the Harris and Bronson Company emphasizes, the line could not address the needs of its best clientele and it constantly suffered from the convenient, less costly river barging of lumber.... "having had trouble enough with the RR officials to satisfy us for life if no other way of Shipping Lumber will do we choose to be excused from shipping at all.... the matter of shipping this small amount of lumber to you has been a whole winter long annoyance an incorrigable" (sic) set of heedless drones the whole pack....".[11]

Another local entrepreneur vital in the shift to the American market was Joseph Merrill Currier. A Vermonter, Currier arrived in the area around 1837 and worked in various deal and saw mills, finally managing the MacKay enterprise. In 1853, he rented these mills in partnership with Dickinson specifically to pursue the American market. Currier developed extensive interests in the Ottawa area, associating himself with the Blasdells in both milling and the Victoria Foundry, which supplied iron goods to the lumber trade, and later with the Wright family which had founded the village of Hull across the river from Bytown. He married into this family in 1869 and became involved in a large steam sawmill. Currier was also among the first of the sawn "Lumber Barons" to recognize the need to become involved as a political facilitator-- serving first on city council and then entering the Legislative Assembly in 1863 as member for Ottawa. He viewed his primary political role to be a representative of the interests of the Ottawa Valley lumber industry and did so until his retirement in 1882.[12]

As mentioned earlier, the Gilmour Company renovated its deal mills after they collapsed in 1849-50 to attempt to break into the American trade. Allan Gilmour moved up to Bytown from Montreal in 1853 to take over their management and four years later employed the fine mill-wright and manager John Mather to totally revamp the operations to compete with the modern installations at the Chaudiere.[13] However, Gilmour, Currier, and Dickinson formed the backbone of the local elite interested in sawmilling and they hardly had the wherewithal to occasion more than a modest industrial growth. Bytown wanted more and it set out to deliberately create the conditions for this to occur.

The first step in local boosterism was to let prospective investors know about the resources and advantages of the area. No organized campaign was undertaken but Henry Franklin Bronson, cofounder with John J. Harris of the Harris and Bronson Lumber Company, first heard about the Ottawa Valley from travellers in up-state New York in 1848.[14] He visited Bytown the next year and was impressed both with the amount of pine available and the unused waterpower available at the Chaudiere. He returned in 1850 with Harris, the firm's senior partner, from Queensbury County, New York. Harris too was impressed but wanted guarantees as to both a power site and a supply of timber for the proposed mills.[15]

Harris and Bronson may have been the first but they were also typical of the American entrepreneurs who came to Bytown after 1851. For the most part, they had been operating in the Vermont and the Lake Champlain - Glen Falls area of New York State. Most were already engaged in sawmilling and forwarding businesses. The supply of timber in most of these areas was substantially reduced and all were looking for new business opportunities. Indeed, many of the families involved split, with some members heading north while others moved to the forests of Michigan and Wisconsin.Among the eventual new-comers to Bytown would be Capt. Levi Young, William Goodhue Perley and, his partner, C.B. Pattee, who would build new mills and Alan H. Baldwin, who assumed ownership of the Blasdell, Currier and Company's mill at the Chaudiere in 1854.[16]

Having elicited interest, the Bytown's developers now needed to begin to fulfil Harris' conditions. In late March, John Egan, scion of the older square timber elite and major political spokesman for the area, sent a memorial to the Governor General on behalf of the inhabitants praying to have the water privileges at the Chaudiere on government property thrown open to public competition for purchase. The local newspaper, the Citizen, saw Bytown as the Lowell of Canada and declared that "inducements should be held out by government to such as are disposed to make investments, provided the privileges are improved upon and made available for factories and such like improvements".[17]

On 30 June 1852, the Government of the Province of Canada recognized the memorial presented by Egan and authorized the expenditure of 1100 pounds for the construction of a dam and other works at the Chaudiere which were necessary for the creation of hydraulic lots and for the sale of such lots.[18] The sale was set for 1 September and, upon his arrival in Ottawa, John J. Harris was given a public dinner presided over by R. W. Scott, Mayor of Bytown and a major local power in the Reform Party which formed the provincial government of the day. At the dinner Harris renewed his commitment to purchase suitable hydraulic lots at the Chaudiere and the community undertook to discourage adverse bidding in order that these lots could be acquired at a reasonable price.[19] In short, Yankee business acumen had met Canadian political accommodation and a deal struck. Rights to the lots required for a mill complex were acquired by Harris for 1 shilling over the upset price of 50 pounds.

The government was true to its word, commencing major improvements at the Chaudiere in the spring of 1853 under the supervision of Horace Merrill, the new Superintendent of Public Works on the Ottawa. This included a dam and bridge and road work, all of which were to be constructed and kept in repair through rental fees paid by the mill owners for water used.[20] For their part the new "American Community" considered that they had come to Bytown only after a fairly substantial pledge from the Canadian government to support their endeavors. Indeed, they were still to claim in 1871 that they considered that undertaking to be an unwritten contract with the government,claiming petulantly,

> some of the undersigned were the first who inaugurated the milling enterprise at the Chaudiere by American citizens (some of whom have since become subjects) which has grown to such vast and beneficial proportions, and did so on the distinct understanding, amounting to an absolute though unwritten obligation on the part of the Government towards them, that they would be guaranteed every privilege enjoyed by subjects with regard to timber limits for the supply of their mills.[21]

The Yankee millers were to find that unwritten contracts did not mean much to Canadian politicians. That realization was to have not a very salutary effect on the moral state of politics as the "Lumber Barons" of the Chaudiere found in the 1870's that they must learn the practice of using raw power and bribery to gain their ends.

That, however, is another story and it is necessary here to turn to the question of what exactly the American community brought to the Ottawa Valley in the 1850's which enabled them to transform Bytown from a rude frontier town to a major industrial centre. Basically, this can be broken down into three attributes which provided considerable advantages.

First, entrepreneurs like John J. Harris had access to a quite different, American-oriented credit line which provided capital specifically for building mills and purchasing limits. R.W. Scott observed in his Recollections of Bytown that no local bidders could develop the privileges at the Chaudiere "since all available capital was invested in the square timber trade and in timber limits".[22] This is not quite a true statement since the Blasdell and Currier interests acquired privileges at the Chaudiere and Phillip Thompson, who had a small mill there, expanded significantly. However, the former businessmen did sell part of their operations to the American A.H. Baldwin in 1854 and it was true that financial institutions, such as the Bank of Montreal, remained preoccupied with investments in standing timber as opposed to mills.[23]

On the whole the Americans generally found Canadian banking and credit institutions unsatisfactory and uninterested in their new north-south trade. Harris and Bronson,for instance, brought with them extensive connections with local banking and lumber wholesaling partnerships in and around Albany and Troy, New York, including most prominently Tracy Cowen of Troy and Peatt, Getman and Harris. It is, however, easy to over-emphasize the magnitude of the investment involved. It was large by local standards but still manageable within the personal financial sphere of the new sawmill owners. By way of example, Harris and Bronson were able to finance the purchase of major timber limits from square timber king, Peter Aylen, Sr., through the negotiation of a series of notes, most for the sum of $2000 with wealthy New York farmers who were acquaintances of J.J.Harris.[24] Indeed, most of the Yankee firms retained at least one partner who continued to live in the United States and who nurtured its financial and business interests there. In the case of the Harris and Bronson Company, J.J.Harris continued to live in New York state and only came to Bytown each spring for the log drives. Thus through natural proclivity and careful use of allied firms and individuals, the " American community" could turn its back on the traditional credit lines for the Ottawa Valley, running down to Montreal, Quebec City, and eventually to Great Britain, and bring in new sources of capital to finance their operations. This was to prove a boon in the 1850's but became an increasingly difficult problem in the 1860's as the companies became more naturalized to Canada but out-side the traditional east-west trade structure of the emerging nation.

Second, entrepreneurs, like Henry Franklin Bronson, brought a new scale of mill technology to the Ottawa Valley. It is well to remember that the investment for the mills of 1853 was not that recorded in for 1871 but they were still magnitudes larger than anything that had gone before. The Blasdell mill at the Chaudiere was planned to cut 40,000 logs annually. The Harris and Bronson mill was built to accommodate over 100,000 logs annually. H. F. Bronson, like many of his compatriots, was an accomplished millwright who built his own saw carriages for the ubiquitous Yankee gang-saw which rapidly came to dominate the mills.[25] The mills, themselves, were large, two stories with dimensions of 100 feet by 80 feet and flumes and foundations constructed of masonry and cement.[26] The Harris and Bronson mill had eight gates of either 26 or 12 saws while the Blasdell had one gang saw.

In addition, the Americans appear to have had more knowledge about and experience with the control of large, fast-flowing streams for hydraulic power purposes. They rapidly built the flumes, dams and holding basins required to service their mills. Upriver, in the interior, they were quite willing to draw on the knowledge of local experts such as James Skead, who had surveyed many of the tributaries of the Ottawa for dams and slides. As well, they quickly moved to improve the streams on which they had limits, with a view to expediting the delivery of logs. Finally, the Yankees brought to all these endeavors an efficiency rarely seen in the Valley. This is best illustrated by the Ottawa Citizen when its correspondent marvelled at the new mill of the Harris and Bronson Company and concluded that "all the work has been done in one summer".[27]

The third advantage was the new firms' direct connection with the American market. Again, by way of example, Harris and Bronson operated through firms in which John J. Harris was either a partner or with whom he had a personal working relationship. These included Folsom and Arnold in New York state and Lawrence Barnes of Burlington, Vermont.# Indeed, much of Harris and Bronson's lumber was sold on commission, the whole cut being committed at a set price to two or three wholesale firms even before the timber was sawn. These connections gave the "American community" a tremendous competitive advantage over other operators in the area.[28]

The conditions outlined above went along way to making sawmilling a major industrial enterprise at the Chaudiere. There was impressive growth in production. The year 1851, a depressed one for the trade, had seen only 3 million board feet cut but this had jumped to 20-25 million board feet in 1859; 45 million board feet in 1862 and 100 million board feet in 1868. This increase was due in good part to the Reciprocity Treaty with the United States which began in 1854 and ran until 1866.[29] This treaty permitted free trade in natural products, including sawn lumber, between the United States and the colonies of British North America.# There is no doubt that this growth in sawmilling had a profound effect on Bytown. As early as the fall of 1854 the Citizen reported that the industrial developments at the Chaudiere had caused a shift so that about a quarter of the town's population was now concentrated in that vicinity and that the mills were attracting a superior class of intelligent and experienced mechanics to the area.[30]

It is, however, easy to over-emphasize these developments and assume that a large industrial complex grew up over-night, with little difficulty. An analysis of the business records of the Harris and Bronson Company reveals a very different story. It invested $80,000 in mills and over $20,000 in the purchase of timber limits from Peter Aylen. Sr. and the estate of John Egan. Their money was tied up in these endeavours and could not be easily got out since many thought the Ottawa Valley enterprise to be the height of recklessness and had advised Harris not to undertake an investment where most New York lumbermen were convinced that logs could not be driven to the mills down the wild tributaries of the Ottawa.[31] Credit could be obtained but it was not abundant and the firm had to gamble that the new trade would develop rapidly enough to keep it solvent. The company brought in a new partner, William Coleman, another New Yorker, in 1853 to help finance the Canadian venture but even in the year 1861 a downturn in trade caused by the Civil War in the United

States and difficulty in getting down logs nearly forced the company into bankruptcy.[32]

The precarious nature of the enterprise is best summed up in a letter from W.H.McIntyre, mill manager in Ottawa, to Allan Jones, boss on the drive on the Madawaska River,

> We saw James Skead yesterday and he says that if the logs were his he should rather they would stop a week or more than not. The Madawaska is awfully high, runs over the bridge at Arnprior and is breaking booms, tearing up dams and raising the devil generally. You had better leave enouigh men with your logs and make it safe and go back to Boyd (other drive) and bring up the hind drive and play to save your men, to save your logs and save money. The times are awful. You know nothing about it and it is best for you are better off by not knowing any thing about it. Do the best you can Allen much depends upon you, you have a great deal of Property in your hands and do all you can to save it.[33]

What is evident in the Harris and Bronson records is that these were not the fabulously wealthy Yankee investors described by the Ottawa Citizen of the time and many commentators since. Rather, they were entrepreneurs with a limited amount of money which they invested to catch a main chance on the Canadian timber frontier, just as they had done in northern New York state and Vermont. John J. Harris referred to himself as a miller and farmer throughout his life. A practical man used to working with and redesigning equipment, managing a log drive and making the personal financial arrangements which were based on reputation and friendship with local New York state bankers and wholesalers. Harris had a variety of interests throughout the northeastern United States, none of them large, and on his death he was considered well-to-do but far from wealthy.

Likewise, Henry Franklin Bronson, who was to carry the firm to first rank among lumber companies, was in these early years a junior partner, who had purchased full equity in the firm as its Canadian agent in 1852. He had entered Harris' service early in life, learned the trade of mill-wright on the job and risen on his own initiative. Bronson too was at home on the mill floor, at the shanties and on the river though he was also adept at negotiating business arrangements, particularly in developing lines of credit after the firm failed to reach accommodation with Canadian banks in the early 1860's. Only in the mid-1860's did the firm's business reach the $100,000 mark annually and a strong financial footing achieved.

Indeed, the retirement of John J. Harris in 1866 marks the turning point for the company. It was by then a large and growing firm by Canadian standards, with a third share in its interests costing the wholesalers Folsom and Arnold $125,000.[34] But more important was that the Ottawa end of the business had grown large enough under H. F. Bronson to dominate its other constituent parts. It had ceased to be an extension of American interests into Canada and the partners in Canada began to control, in large part, the company's destiny, especially the opening of markets and re-investment of profits. In short, the new Bronsons and Weston Company which eventually emerged from these arrangements was geared to operating on a North American scale but was also firmly oriented to its Ottawa base and its growth and development.

With this over-view in mind, it is worthwhile to return to Professor Taylor's assertions about Ottawa's failure as a metropolis in arriving at some tentative conclusions about the entrepreneurial abilities of the "American community" at the Chaudiere. If the Harris and Bronson Company is typical then the mid-1860's are an important water-shed in the economic and industrial history of the Ottawa Valley. It is inaccurate to assume that the new mill-owners were in a position to be an aggressive, dominant economic force outside their immediate sphere of influence in the 1850's and early 1860's. Time and much money was expended in developing mill and power sites at the Chaudiere; in locating timber and purchasing timber limits and in undertaking river improvements to facilitate the driving of logs to the mills.The only thing that was reasonably sure in the early years for the Harris and Bronson Company was that they could generally market their product if they could obtain it and get it to the mill. All the firm's discretionary resources went to ensuring these ends.

The conclusion is not profound. The "American community" simply needed time to develop the sawmilling industry at the Chaudiere. It is often stated with some surprise that the Yankees isolated themselves from the rest of the business elite of Bytown and that this contributed in a major way to the failure of the area as a metropolis. Yet it is interesting to note that as early as the summer of 1854, the "American community" was busy meeting and petitioning the government for better holding areas for logs above the Chaudiere. At these meetings they are joined by members of the older square timber elite such as James Skead and J.M. Currier who were interested in the industrial development of the town. # As well, no sooner was Ottawa incorporated as a city in 1854 than these businessmen were making their presence felt in Victoria Ward, the area encompassing the Chaudiere.[35] Likewise, in 1859, when area lumbermen gathered to make resolutions to the provincial government on the granting and tenure of timber licenses and classification of timber lands, the Americans were present and made specific resolutions for improved navigation to ease the cost of supplies and to open the Chicago market to Ottawa Valley lumber.[36] In 1860, H. F Bronson became a regular member of the executive of the Ottawa Board of Trade.[37]

These references put the theory of isolationism in some doubt. A differentiation was made between square timber makers, who formed a more established economic elite in the area, and the newer millowners making sawn lumber, up to the early 1870's.[38] But the square timber men were capital poor and welcomed the new entrepreneurs, who could diversify the trade and buy up their timber leases. The two communities met and cooperated with each other. Indeed, a milestone was passed in early 1863 when H. F. Bronson and Captain Levi Young were accepted by the older elite, headed by Allan Gilmour, as members of the first Ottawa Municipal Reform Association aimed at bringing "honesty and economy into the management of municipal affairs", particularly in regard to the reckless investment in railways through municipal bonds.[39] It was not that the "American community" was isolated from the economic life of Ottawa but rather that it reserved its interventions for those issues in which its members had a direct interest.

Indeed, these businessmen were integrating themselves slowly but surely with the older business and political elite in Ottawa to form alliances to protect these very interests. It would be increasing threats to tenure rights and water privileges after 1870 which would propel these entrepreneurs fully into provincial and federal politics, where they initially relied on the good services of J.M. Currier and R.W. Scott. In the same way, the "American community" came to rely to some extent on relations with the older elite to persuade Montreal bankers to supplement their other sources of credit. By the 1870's representatives of the banks were lobbying for the lumbermens' rights before the provincial governments of Ontario and Quebec and Ottawa would spawn its own lumbermens' bank to finance their various activities.

In transportation,as well,the "American community" also made attempts after 1865 to promote and develop canals and transportation companies, such as H. F. Bronson's Union Steamship Company, designed to ease the movement of supplies into the up-country lumber camps, the driving of logs to the mills, and the delivery of lumber to market. Within Ottawa itself, the lumbermen developed the first street railway in 1866 and, in 1879, J.R.Booth, a Canadian who was to become the most powerful of the "Lumber Barons," and W. G. Perley, a prominent member of the early "American community", financed the Canada Atlantic Railway. This latter venture, built with considerably less public support than many lines elsewhere in Ontario and Quebec, pushed a route from the northeastern United States to the northern Great Lakes which by-passed both Montreal and Toronto and firmly expressed Ottawa's desire to be the metropolis for a resource rich northern hinterland.[40]

In conclusion, what emerges in the two decades after 1852 is not an "American community" in Ottawa which was inward looking and isolationist. Rather, these entrepreneurs had slowly but surely merged their interests with the aspirations of Ottawa to become a major industrial centre. They viewed themselves and were viewed by the community itself as bringing a major new industrial technology to the area which would fire industrial growth.The result was a powerful interest group which identified the best interests of the city with those of the lumber industry in eastern Ontario and western Quebec.

For the area around Bytown (becoming known as Ottawa in 1855), this merging of interests provided the basis of thirty years of sustained industrial growth based on the forest industries. During this period, Ottawa became a major urban centre with an industrial and business elite which represented and defended the city's rights and privileges as essential to its own economic well-being. For the Ottawa Valley after 1870, the era of the "Lumber Baron" had begun. The decline in the industrial base, when it came after 1900, is too easily blamed on the ephemeral nature of the forest which was plundered by the Valley lumbermen. During the last half of the 19th century, there would be a tremendous battle for the hinterland of northern Ontario and Quebec, waged against a backdrop of national economic policies oriented to creating a nation on an east-west axis but seduced by north-south trade patterns. It was a battle the Ottawa entrepreneurs were to lose but not because they isolated themselves from the fray or lacked a vision of the possibilities of the forest industries as providing the technological and industrial engine for their particular commercial empire.

FOOTNOTES

1. National Archives of Canada (NAC), Bronsons and Weston Company Records, MG28 III 37.

2. NAC, Statistics Canada, RG 31, A1, 1871 Census, schedule 7, City of Ottawa.

3. John H, Taylor, Ottawa: An Illustrated History (Toronto, 1986), Chapter II.

4. For an overview of this development see J. W. Hughson and C.C.J. Bond, Hurling Down the Pine: The Story of the Wright, Gilmour and Hughson families, timber, lumber manufacturers in the Hull and Ottawa region and on the Gatineau River, 1800-1920 (Old Chelsea, Quebec, 1964).

5. S. Gillis, The Timber Trade in the Ottawa Valley, 1806-1854 (Parks Canada, Manuscript Report 153, 1975), pp.91-102.

6. Hughson and Bond, p.39.

7. See R.P. Gillis, Allan Gilmour of Shotts, Dictionary of Canadian Biography (DCB), Volume XII (Toronto, 1990).

8. Hughson and Bond, p.39.

9.Ibid., p.41.

10. Taylor, pp.48-9.

11. Bronsons and Weston Records, volume 91, W.H. MacIntyre to L. Barnes, 10 April, 1860.

12. Currier's career is outlined in R.P. Gillis, "Rivers of Sawdust: The Battle Over Industrial Pollution in Canada, 1865-1903", Journal of Canadian Studies, volume 21, no.1, Spring, 1986.

13. Gillis, DCB, volume XII.

14. Bronsons and Weston Records, volume 868, Family Documents.

15. Ibid.

16. J.E. Defebaugh, History of the lumber industry of America, 2 volumes (Chicago, 1906-07), volume 1, pp.157-160.

17. Ottawa Citizen, 27 March, 1852.

18. NAC, Records of the Executive Council, RG1, E1, Book M, Report of Council, 30 June, 1852.

19. NAC, R.W. Scott Papers, MG27 II D14, volume 5, Recollections of Bytown.

20. Ottawa Citizen, 19 March, 1853.

21. Ibid. and Bronsons and Weston Records, volume 93, Millowners at the Chaudiere to Hon. J.O. Beaubien, Commissioner of Crown Lands, Quebec, 7 January, 1871.

22. Scott Papers, volume 5.

23. Ottawa Citizen, 13 December, 1857.

24. Bronsons and Weston Records, volume 816, Agreements and contracts.

25. Ottawa Citizen, 22 October, 1853, and G. M. Rose, ed., A Cyclopaedia of Canadian Biography: Being Chiefly Men of the Time: A Collection of Persons Distinguished in Professional and Political Life; Leaders in Commerce and Industry of Canada and Successful Pioneers (Toronto, 1886), volume 1, pp.347-48.

26. Ibid.

27. Ottawa Citizen, 22 October, 1853.

28. Bronsons and Weston Records, volumes 91-94, Letterbooks, 1854-1860.

29. Hughson and Bond, p.44 and D.C. Masters, The Reciprocity Treaty of 1854 (Toronto, 1963), pp.3-10 and 64-80.

30. Ottawa Citizen, 2 September, 1854.

31. Bronsons and Weston Records, volume 816, Agreements and contracts.

32. Ibid., volume 868, Family Documents.

33. Ibid., volume 91, W.H. MacIntyre to Allen Jones, 15 May, 1861.

34. Ibid., volume 817, Agreement for sale of interests of J.J. Harris.

35. Ottawa Citizen, 29 July, 1854.

36. Ibid., 23 December, 1854.

37. Ibid., 27 December, 1859.

38. Ibid., 31 January, 1860.

39. Ibid., 3 January, 1863.

40. For a detailed analysis of these developments see R.P. Gillis, William Goodhue Perley in DCB, volume XI (Toronto, 1982), pp. 681-82, and R.P. Gillis, E.H. Bronson and Corporate Capitalism: A Study in Canadian Business Thought and Action, 1880-1910, Masters Thesis, Queen's University, 1975, Chapter VI.

FORESTRY AS OPPOSED TO NATURE CONSERVATION?

THE DEVELOPMENT OF AUSTRIAN SILVICULTURE DURING THE FIRST HALF OF THE TWENTIETH CENTURY AND ITS CONTRIBUTION TO NATURE AND LANDSCAPE PROTECTION

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SUMMARY

With the increasing use for the satisfaction of human needs the idea of nature conservation was taken up by various friends of nature in the second half of the 19th century. In this clear cutting systems causing the reduction in the abundance of types of trees were rejected. Avoiding a stereotypical pattern of management a renewed adoption of natural forms of forest cultivation as well as natural systems of regeneration and the cultivation of mixed forests were silvicultural measures to maintain a natural forest structure. In this foresters met the demands of nature lovers and conservationists to a large extent in the first half of the 20th century.

Keywords: nature conservation, naturally conditioned forestry

1. INTRODUCTION

Even in a cultivated forest there was originally a balance between natural resouces and human needs. Man with regard to economy, type of settlement and population was part of a harmonic natural whole. With the advance of technology and increasing industrialization this century old harmony between man and his surrounding was disturbed towards the end of the 18th century (Wendelberger, 1952). Contributory factors were the increase in population, industrial conurbations and cities, the increasing job specialisation, the growing pollution of the environment through industrial waste and the increasing restrictions imposed on the individual in the interest of the community (Siefert, 1907).

When towards the end of the 19th century the conflict between modern industrial society and nature became more marked, man's attitude to nature changed (Dimitz, 1907). Attitude here signifies the disposition of one person (or group of persons) to comprehend evaluate and treat objects within their range of experience in a certain way (Schulz, 1985).

The "return to nature" as proclaimed in art became apparent also in the spirit of the whole period and in the conduct of life. The further the cultivation of soil and industry developed, the more an extensive stay in the open was considered necessary as beneficial for body and soul (Siefert, 1907).

Up to the second half of the 18th century the protection of nature had not been necessary, but with the increasing anthropogenous influences their limitations became necessary (Dimitz, 1907). With the increasing use of nature for the satisfaction of human needs the idea of nature conservation was taken up by various friends of nature in the different civilized European countries simultaneously (Schröter, 1911).

The protection of natural landscapes and the conservation of nature-monuments were only part of the demands made by them. The ecological goal eventually set was the protection, conservation. promotion and safeguarding of nature for its own sake.

Nowadays the term nature conservation comprises all the measures for the protection, preservation, promotion,safeguarding utilization and use of forests (Schulz, 1985). As long as a society however does not build up a system of values which adapts its own needs to that of nature there will always be conflicts concerning the aim within this framework of the definition of nature conservation.

2. THOUGHTS ON THE DEVELOPMENT OF THE IDEA OF NATURE CONSERVATION

The love of nature and its beauty which became publicly more and more noticeable, resulted in the fact that conservation of nature came to be considered a task both for the individual and the state. Legislation and administration issued norms to express this deeply felt general need. The penetration of society into nature at the beginning of the 20th century was so intense that its protection was considered necessary. Therefore the representatives of the idea of nature conservation postulated respect for the beautiful and the sublime, for that which was scientifically valuable and at the same time typical of the nature of a particular country. It was pointed out that the love of nature and its monuments was common to most people and went far beyond the love of history and art. Love of nature was the reason too why the rural population declined decisive alterations of the landscape which frequently in connection with big modern projects (as for example the use of waterfalls and mountain streams for the production of electrical energy) threatened the beauty of the landscape (Dimitz, 1907). Although one did not see a possiblity to stop these processes, however, by the reduction of such projects one could contribute to the preservation of nature to some extent.

An transition to an organized preservation of nature and its monuments was achieved in Austria by a series of laws issued by the federal state parliament which were designed to save certain plants and plant communities (Edelweiß, Cembran pine) and animals from extinction. Around the turn of the century the conviction was prevalent that the conservation of nature and its monuments should be precisely defined and should be protected by the state in the same way as historical monuments and monuments of art. The individual held the community responsible for the disadvantageous consequences of civilation (hectic states, impenetrable complexity, deadline-pressure) and liable for compensation (Dimitz), 1903).

3. MOTIVES FOR THE PROTECTION OF FORESTS

More than a third of Europe is covered by forests,in Austria forests cover approximately 50% of the total area; because of its extent, its nature and its influence on the shape of the landscape the forest is best suited to serve the need of the population for recreation. Foresters could not close their eyes to the desire expressed by many for the protection of nature and the preservation of the natural beauty of the forest (Siefert, 1907). The forester seemed predestined due to the nature of his profession to become active in trying to achieve this aim. This became possible to some extent by the way in which the forests were managed. It was useful firstly for the forest itself having it protected by the public, better than would have been possible merely by issuing forestry protection laws; secondly, for the forest owners and their representatives because of the recognitionof the population for having cared for the forest; thirdly, this caused the managers to carry out their duties with greater devotion which again had repercussions on the way the forests were managed (Siefert, 1907).

Forests and their management were seen as having an interrelated place in nature since the beginning of the 19th century. This is shown also in the old Austrian forestry laws (i.e. the "Reichsforstgesetz" of 1852). The ideas of nature conservation were first put into practice in the legislation for forestry conservation (Dimitz, 1907).

Since the idealistic motives of the ancients for the protection of forests from anthropogenous influences the reasons have undergone changes, just as culture has, but only few have become irrelevant. Some reasons for the conservation of forests are as follows: Secondary yield, hunting, sustained timber supply, military strategic use, securing of afforestation and servitudes, protection forest against avalanches, landslides and torrents, indirect forest effects, recreation and socio-political reasons (Dimitz, 1892). Towards the end of the 19th century the ethical and aestethic importance of the forest became of paramount importance although the forest as a means of timber supply had not lost its importance.

Siefert (1907) at the beginning of the 20th century saw the following possible conflicts (which should however not deter foresters from putting into practice the idea of nature conservation). 1. Damage to the forest by the general public; 2. the aesthetic feeling for the forest as seen by artists and nature enthusiasts; 3. the realisation that the majority of people have lost their feeling for nature.

4. IDEAS OF SILVICULTURE AT THE BEGINNING OF THE 20th CENTURY

In the transition from the original forest stand to the cultivated forest forestry has taken variouus paths which were influenced by: 1. temporary economic needs; 2. prevalent academic views on forestry (Dannecker, 1952).

The forest in its original composition was endangered to a high degree by a continous progress of civilization. While before only individual trees or groups of trees had been cut down and the thus existing gaps were filled in naturally, in the second half of the nineteenth century the even-aged closed forest with clear cutting and artifical regeneration was considered the modern system of forest management (Vogl, 1902).

Because of this way of management the original types of wood had partly completely disappeared. This was without importance for the forest economy but of great importance to the nature enthusiast and scientist. The lime tree, types of common maple, ash, jew, juniper ect. and many herbaceous plants, ferns, moss together with animals living in interpendence of each other disappeared. The natural forest with certain plant communities had been replaced by an artifical forest with few types of wood yielding maximum profit. The purpose of this kind of forestry was purely economical, i.e. it was to secure for forestry owners a sustained high interest as well as the sustained yield of financial rotation. Nature was not taken into consideration, it had to submit to the "art of forestry". With the reduction in the abundance of types of trees not only the forest stands but the whole scenery changed (Conwentz, 1907). From these considerations it was desirable from a scietific, aesthetic and ethical point of view that forestry turned away from the sober view of pure profitableness and did not deny nature conservation its rightful place (Mayr, 1941).

5. MEASURES TAKEN FOR THE REALISATION OF THE IDEA OF NATURE CONSERVATION

5.1. Care of the beauty of the forest

Among foresters at the turn of the century the nature of beauty in nature was discussed - i.e. wether or not everything in nature could be called beautiful. A tree could fulfill the precondition for the idea of beauty only if it was impeded as little as possible in its natural development. These criteria were best fullfilled in a tree that had grown in an open position the criteria for its beauty were opposed to those from a forester's point of view. If we consider the wood as composed of individual trees then it is proofed that its beauty does not consist in the evenness and monotony of a monoculture of equal growth but in the abundance and variation of mixed forests of unequal growth. The beauty of a forest is influenced by the composition of the types of trees present and also by the way of its management - i.e. the nearer it is to the original natural type of forest the more beautiful it will seem to be.

Not every wood is a cultivated forest but every cultivated forest is woodland. Various ways of management have created the various cultivated forests which can only be called beautiful if the influence of man is not immediately apparent, for example if in a seedling forest one works with natural stands. Conflicts in the system of management arose because people demanded that a forest should above all yield timber, not beauty.

Guttenberg (1889) was of the opinion that a cultivation necessarely directed towards a certain yield did not exclude the cultivation of beauty. Beauty could be justified without limiting practicality if foresters did not work against nature but followed its example (Vogl, 1902). Because their work leaves its mark on nature farmers and foresters should consider it their duty along with the production of consumer goods to safeguard and maintain that aspect of nature which offers recreation and is precious and suited to please through its contemplation. This view was expressed already in the forest and agricultural literature of the second half of the nineteenth century.

The idea to cultivate the beautiful dates back to Salisch (1885) in Germany and to Guttenberg (1889) in Austria who introduced the aesthetic aspects of forestry as an independent topic into literature. König, Grebe, Altmeister, Burckhardt, Rossmässler et alii wanted to see the forest not only as economic property, cultivated to produce a certain yield, but equally, as a source of pure enjoyment.Accepting the fact that the maintenance and cultivation of the beautiful in nature and especially in the forest was an expressive need of modern man, foresters and politicians had to ask themselves how such goal could best be reached.

At first one considered the possibility of introducing measures in the forest which would protect the natural beauty of the landscape. These were comprised in the term aesthetics of forestry. Dimitz at the International Agricultural Congress in Vienna in 1907 introduced the following catalogue of measures which to a large extent was identical with that of contemporary colleagues such as Conwentz (1907), Grebe (1875), Guttenberg (1889) and Kozesnik (1904).

According to Salisch (1885) aesthetics and economic practicality should be effective side by side and the aesthetic side of forestry could not be practised at the cost of a diminished yield. The following criteria were decisive for the attainment of the aesthetic goal: The choice of how to cultivate the soil, how to utilize it, what kind of wood to choose, how to regenerate the forest and improve the stand; of further importance were the design of the forest road network, the division into compartments and a series of measures to improve the aesthetic aspects of the forest taking into consideration the aesthetic value of meadows, hedges, waters and fences. It was possible to combine economic planning with the basic principles of aesthetic (Kozesnik, 1904). The cultivation of beauty in the forest took two directions: 1. to avoid the misuse of nature in its management, 2. to manage the wood according to the principles of art (Dimitz, 19076).

In the second half of the 19th century the precisely arranged young plantations had been the pride of every forester but around the turn of the century one strove for uneven-aged stands by trying to arrange a natural felling sequence. In this foresters met the demands of nature lovers and conservationists to a large extent.

5.1.1. Natural silviculture treatment of cultivated forests

If the forester keeps the forest in a visibly good condition it will seem important to the population and the more pleasure forests offer to the hiker the more care he will take not to do anything that might be harmful to the forest (Grebe, 1875).

Only a silviculture which is based on natural principles corresponds with the demands of nature conservation. The manager, conscious of the need for nature conservation must attempt to maintain a natural forest structure. Part of this is the avoidance of following a stereotyped pattern of management and the renewed adoption of natural forms of forest cultivation (i.e. selction forest, open stand system) as well as a natural system of regeneration and the cultivation of a mixed forest .

Since Carl Gayer this view became more widely accepted. He said:"The uniform stands of the clear cutting system are not to be the only justifiable type of forest, a return to a natural type of forest is essential to the future." According to Dimitz (1907) clearings at least in high mountain areas could not be totally avoided but considerably reduced. Siefert (1907) however declined clear cuttings since he considered them a brutal destruction of the forest scenery which lasted for decades and together with other authors he criticized the uniformity of stands which arose from this system and also its instability.

5.1.2. Influence on the forest according tc artistic principles

According to Guttenberg (1889) the cultivation of the beautiful by farmers and foresters consisted to a large extent of the maintenance of its natural beauty. According to Grebe (1875) their task was to contribute to the flourishing of the forest by cultivating the forest and its growth and by this to regain the support and appreciation of the general public for the activities of the forester. Forestry experts were in agreement to a large extent as to how to improve the disagreeable sight of even-aged plantations and thus contribute to the beautification of forest stands (Wiehl, 1908, Salisch, 1885).

In building new forest roads it was essential to take into consideration not only the transport of timber but also aesthetic viewpoints. The edges of roads and rides were to be replanted in the same way as the edges of felling areas and young plantations, i.e. either with pioneer types of wood (ash, silver birch, common beach) or with valuable broad-leaved types of trees or other rarer types which could then intermingle with the existing stands and could have a stabilizing influence.

With regard to the types of wood chosen the manager should utilize the available spectrum. Even if a choice has to be made according to economic principles, practicality as well as beauty should play a role, for example through the intermixture either in hursts or groups of other types of wood apart from the main species favoured for economical reasons. Further measures to make the forest more beautiful were, among others as follows: The maintenance of old trees or groups of trees (Guttenberg, 1889), the cultivation of shrubs and ground cover, the upkeep of nature monuments and ruins and the opening up of good views (Salisch, 1885), The aesthetic value of meadows, waters, hedges and fences was pointed out.

5.2. Conservation of natural monuments

The following are considered natural monuments (Dimitz, 1907; Conwentz, 1907). Natural formations of the earth surface or interior, i.e. water courses, trees, rocks, the preservation of which for historic scientific or aesthetic reasons was in the public interest. The desire for protection was fulfilled by individual legislation for particular counties of Austria.

Various experts and organisations of were asked by the Central Government and the Ministery of Education to nominate monuments worthy of protection. It was expected that forestry experts would promote the above efforts by finding, choosing, naming and supervising such objects on a voluntary basis.

5.3. Exclusion of nature preserves

In order to preserve natural landscapes, natural stands or those which contained species of wood threatened by extinction were to be excluded and especially protected. Virgin forests, moorland, habitats of rare plants ect. were to receive special protection. Around the turn of the century six nature reservation areas existed in the Austo-Hungarian Monarchy (Conwentz, 1907) which had been founded through the initiative of some specially devoted forestry-owners. To these belonged and still belong the Gottscheer virgin forest in Krain, the woodlands of Kubany in Bohemia and the large virgin forest at Dürnstein in Lower Austria.

In forestry circles one could not agree wether the elimination of woodland for recreational purposes was part of the nature conservation programme or not. It was agreed however that forests especially near large cities, holiday resorts or spa-towns (for example the green-belt of woodland and meadows around Vienna or the forests of Karlsbad) had to be cultivated according to aesthetic principles and that clear cuttings had to be avoided.

In the "Reichsforstgesetz" of 1852 no rules were contained on the management of forests according to ethical or aesthetic principles - it was up to the individual to make a choice. Therefore - despite the agreement in principle by foresters - a strong opposition by forestry owners often existed against such consideration,especially if no adequate compensation was offered.

In 1911 in Germany as well as in Austria the call to found nature reservations was made by a society specially founded for this purpose which had prominent persons among its members. the purpose of the association was the creation and administration of nature reservations in which nature was to be maintained in its original state. Modern forestry was considered the arch-enemy of all living creation by this association because of their intensive cultivation of forests; the other arch-enemy was industry because of the damaging effects of noise, the emission of fumes and because of its waste water. The opinion was expressed that because man claimed the largest part of the earth for himself at least a small part of nature should be preserved in its original state (Kemmerich,1911). The movement for nature conservation grew with the increasing industrialisation; in this the principle of usefulness was cast aside as totally insufficient; each bird for instance was to be protected for its own sake and not for instance because it ate harmful insects. All living creatures in a forest were to be saved from extinction - trees, as well as flowers - because they formed an inseperable whole. But their main task was the conservation of typical landscape pictures inclusive of their fauna and flora, as exemplified in the USA.

Through the authority of the nature conservation laws one had the possibility to declare comparatively virginal areas, distinguished by natural beauty as nature conservation areas to protect them from further utilization. In 1911 the project for the creation of a high-altitude natural conservation in the Austrian Alps had progressed far. Various misgivings (concerning forestry hygiene, the economy, biological and conservationist considerations) as well as the question of access had been clarified.Political changes all over the world prevented the realisation of the above plan.

6. NATURALLY CONDITIONED FORESTRY AND NATURE CONSERVATION

Whereas in Switzerland from the turn of the century the rejection of the clear cutting economy had led to a complete prohibition of it and at the same time to a kind of management which was based on the idea of the forest community representatives of this view were Engler, Bühler, Flury, Biolley, Schädelin, Leibundgut) in Austria only a few forestry plants in the flat and hilly areas worked on the basis of natural regeneration (Forster, 1954). In mountainous areas the clear cutting economy continued to be practised. This was due to the world economic crisis and to the events during World War I. The lasting harmful ecological consequences were worsened by over-utilization, neglected cultivation and defective regeneration.

Because of this friends of nature conservation under the leadership of the Austrian conservation movement started a counter-movement which resulted in a series of nature protection laws in the various counties of Austria. They contained a closed system of measures for the conservation of nature in all areas.

After 1938 through the event of World War II and the time after the war the Austrian forests were again over-utilized (Horky, 1952). As estimated by Lorenz-Liburnau (1952) during the 32 years during which over-utilization in forestry took place (including some over-utilization before 1920 to the end of 1951) approximately 80 million cubic metres of timber were over-used. (The normal annual usage of timber in Austria could according to Lorenz-Liburnau be 12 million cubic metres).

Adequate planning and scientific research as well as practical management were necessary to counter the problems which had arisen with regard to silviculture and the biology of the soil and of plants. The modern fundamental view of silviculture as an economy based on a cultivated forest close to nature (Pockberger, 1952) is based on Gayer and Morosow (the forest as a community of living) who based their views on the idea of a natural forest. These ideas coincided to a large extent with the demand made in the 1950ies for the protection of the forest.

To put the ideas of a forestry based on natural conditions into practice a movement which bore the same name was founded in Austria in 1952 with leading experts as its members - such as Pockberger, Tschermak, Schreiber, Wettstein, Dürr, Eckmüllner, Egger, Glück, Horky, Janaczek, Kuhn, Minutillo, Springer, Vospernig and Winkler. Krutzsch used the name for the first time in 1932 as the title for his book about the perpetual forest.

By forestry based on natural conditions the representatives of this movement intended to signify an economic system which had as its aim a natural forest structure which aimed at the highest possible yield with regard to quantity and value as well as at an increase in the productivity of the soil. The interruption in the felling process with following artifical regeneration was to be replaced by a perpetual growing stock and the avoidance of any interruptions in the community of life.

One expected a maximum output with regard to production, but only if the biological community of the forest remained permanetly undisturbed and as far as possible in a natural condition. The forest cultivated by exclusively biological means was to adapt to that condition of a natural wood which yielded the best output (Pockberger, 1952; Hartmann, 1953).

Characteristics from a forestry based on natural conditions was to make full use of the growth potential of the individual tree rather than that of the whole stand. Ways of management were the selection forest, the cutting by group selection method, or the graded wood according to Hartmann, but many variations were possible. Important were firstly a strict selection with regard to the best possible genetic species, secondly, soil improvement through a natural perpetual growing stock and thirdly, a graded structure and a mixture of species suited to the soil and position (Pockberger, 1952; Arbeitsgemeinschaft, 1952).

As their most important task the study group saw the transformation of stands which had arisen by periodical clear cutting into forest based on natural conditions. To chieve this aim excursions, lectures and publications were made and within the work group smaller specialist work groups were formed. Apart from this, sample plots were established and those forestry plants received financial support which attempted to introduce the above change (Allg. FZ, 1952).

According to Pockberger a silviculture based on natural conditions could best fulfill all the cultural demands made by the county. It was not sufficient however if forestry experts were in agreement on the value of the forest and attempted to care for and cultivate it according to the best possible methods. Particularly in Austria where more than half of the area covered by forest is owned by people who own very little land, it is important that the population is conscious of the protective role of the forest with regard to cultivation, the water supply and the protection against avalanches.

The society "Biological Institute" which was founded in 1951 persued the above aim. Later, under the name "Grüne Front" it wanted to win over experts as well as laymen for the idea that the wood had to be protected in a biologically appropriate way. They wanted to make the public aware of the correct attitude and treatment of a forest.

The new silvicultural attitude according to Köstler (1954) did not coincide with the western claim to dominance over nature. The love of nature and the respect for the forces of nature dominated the new attitude. According to Albert Schweitzer man is an ethical being only if he considers life as such, including that of plants and animals as wholy and if he offers help to those in need. This view of the ethical obligation towards life coincided with the basic idea of forest care as developed by König, Gayer, Dietrich, Schädelin, Köstler et al.. For Köstler the idea of care for the forest goes beyond the old concept of a sustained yield; he associated the concept of "care" with that of help and healing.It was not only the thought of a "return to nature" as seen in the second half of the ninteenth century but it went beyond that in that it established a connection with the future.

The idea of care for the forest according to Köstler (1954) should not be confused with that of the nature conservation movement. Indeed it seemed desirable and necessary to protect geological peculiarities as well as rare plants and animals and to preserve old trees and to prevent the anthropogenous destruction of certain landscapes as had been requested by nature conservationists and foresters since the turn of the century.

A modern protection of nature as demanded by Köstler around the middle of the 20th century however necessitates a continuation of the idea of forest cultivation to the idea of care for nature. Care for nature in and outside the forest whose presupposition is an ethical attitude towards nature as professed by Schweitzer could, according to Köstler, render superfluous the conservation of nature as a series of specialized cases. Nature should be promoted by the whole community not just by individual interest groups (Köstler, 1954).

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DEFORESTATION IN THE POST-WAR PHILIPPINES

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SUMMARY

A model of deforestation for the post-war Philippines is presented in which the two main agents of forest destruction are loggers and agriculturists (shifting and permanent). It is postulated that loggers are primarily responsible for converting the primary forest to secondary forest and that agriculturists then convert the secondary forest to farmland. The model was tested using a multiple regression cross-sectional analysis of forest cover at the provincial level for 1957, 1970 and 1980. In addition, a panel analysis from 1970 to 1980 with deforestation as the dependent variable was conducted. Based on this research, the following conclusions are justified: (1) elite control of the forest resource has been responsible for the demise of the primary forest; (2) population pressure was not an important factor in explaining deforestation in the 1970 to 1980 period; (3) previous quantitative work on tropical deforestation which has used forest cover as the dependent variable has incorrectly stated the problem.

Keywords: deforestation, tropical forests, Philippines.

INTRODUCTION

Deforestation has been rapid in the post-war Philippines. From 1950 to the present day, forest cover has decreased from 50% to approximately 20% of total land area. The decline in primary forests has been even more rapid; from approximately 10 million hectares in the early 1950s to less than 1 million hectares today (World Bank 1989).

The present research postulates that the deforestation process primarily occurs in two steps: logging (legal and illegal) converts the primary forest to a secondary forest and expanding agriculture (shifting and permanent) then converts the secondary forest to farmland. The rapid expansion of concession area and logging after Independence in 1946 was the result of elite control of government. The valuable forest resource was awarded to a small number of loggers who were closely allied with political figures. The end result was rapid, widescale destructive logging, massive corruption within the different forestry departments of the government and what the author regards as deliberate manipulation of Philippine forestry statistics to coverup up the resulting destruction of Philippine forests. These practices reached their height during the late 1970s under former President Marcos. The author accepts as valid Bello's (1988) characterization of the Philippine government as a form of 'institutionalized looting.' This is particularly the case when applied to forest resources (Porter & Ganapin 1988).

Concomitant with the rapid destruction of the primary forest by loggers has been the expansion of agriculture (mostly subsistence) onto land previously occupied by old growth forest but now consisting of degraded, secondary forests. This occurred because economic growth in the post-war Philippines, though successful by historical and contemporary standards, failed to reduce poverty and provide sufficient jobs in urban areas. In fact, most observers would agree that relative and absolute poverty have been growing in the Philippines since the 1950s and presently at least 55% of all Filipinos live in 'absolute poverty'; that is, they cannot meet their basic needs.

In short, the two main agents of forest destruction in the post-war Philippines have been loggers and agriculturists. Loggers have converted the primary forest to a degraded, secondary forest and agriculturists have completed the process by converting the secondary forest to farmland. The motivation of the loggers has been financial gain and for the agriculturists it has been subsistence.

DATA SETS

The verbal model presented above was tested in several ways. First, correlation analysis and multiple regression techniques were used to examine the distribution of forest cover across provinces in 1957 (n=52), 1970 (n=68) and 1980 (n=72). Second, panel analysis was conducted for the period 1970 to 1980 (n=67) with deforestation as the dependent variable. Third, a path analysis of deforestation during the 1970 to 1980 period was conducted.

Forest cover data for 1957 is from the National Economic Council (1959). It was not based on remote sensing; rather, it comes mainly from the reports of district foresters. However, given that the national figure for forest cover from the National Economic Council (1959) is almost exactly the same as the figure the present research projected back to 1957, this study felt it would be worthwhile to include this data in the analysis.

Forest cover data for 1970 and 1980 is from the recently completed Philippine-German Forest Resource Inventory Project (Forest Management Bureau 1988). Data is available for forest cover at the provincial level for 1969 and one of the years in the 1980s. This data was then projected to 1970 and 1980 so as to agree with Population and Agricultural Censuses of the same year.

Additional variables available for the statistical analysis can be grouped as follows: demography (total population, urban population, upland population), agriculture (total agricultural area, rice and corn area and production, number of farms), infrastructure (roads, irrigated area), forestry (logging production, number and area of concessions, annual allowable cut), physical (province area and area of arable land) and distance from Manila. In addition, density, percentage and change variables were created from those listed above.

The only variable that requires an explanation is distance from Manila. The interpretation given by this study is that distance from Manila is a surrogate for the amount of control (or lack thereof) of the forest removal process and, as such, it is expected that deforestation would be positively related to distance. This variable is an attempt to capture the effect of corruption on the process of deforestation.

While this is not the place for an extended discussion of the quality of Philippine statistical data, the author is aware that some of the data suffer from serious limitations. This is particularly the case with the logging and road data. In addition, it may be the case that the 1971 Agricultural Census understates the area of farms by as much as 2 million hectares (Gwyer 1978). If so, then the increase in farmland between 1970 and 1980 may be overstated by the same amount.

STATISTICAL ANALYSIS

In general, the statistical analysis consisted of the following steps:

1) variables were plotted to see if any patterns or clustering were apparant;
2) Pearson correlation coefficients amongst all variables were determined;
3) on the basis of step 2, some variables were excluded since they were highly correlated with other variables (e.g., the number of farms was always highly correlated with agricultural area);
4) multiple regressions of the independent variables determined to be important on an a priori basis were run against absolute forest cover;
5) after step 4, step-wise regressions were run to see if any of the other variables were important;
6) the resulting equations were standarized;
7) the residuals were plotted and tests for heteroscedasticity and autocorrelation were performed;
8) if the resulting equations had problems with heteroscedasticity and/or autocorrelation, the variables were transformed logarithmically and re-estimated.

The level of significance has been set a 5% and all variables included in the equations meet this level of significance. In the tables which follow, all coefficients have been standardized and t-statistics are presented in parentheses below the corresponding variable. R-square, F statistics, chi-square (test for heteroscedasticity, where p greater than .05 indicates that the results are significant at the .05 level) and Durbin-Watson (test for serial correlation) statistics are to the right of each equation.

STATISTICAL RESULTS FOR 1957, 1970 AND 1980

Table 1 below presents the multiple regression results for 1957, 1970 and 1980. Both dependent and independent variables are in natural logarithims for the years 1957 and 1970. Since both equations are standardized and in double log form (the L in front of the variable indicates it is a logged variable), the beta coefficients represent the responsiveness of the dependent variable with respect to each of the separate independent variables. The equation for 1980 is not in log form.

Table 1: Multiple Regression Results For 1957, 1970 And 1980.

1) L(FA57) = -0.87 L(RDK)	r2=0.76, F=159 chi-square=4.7 DW=1.70
2) L(FA70) = -0.54 L(POPK) -0.28 L(RDK)	r2=0.58, F=48 chi-square=11 DW=1.66
3) FA80 = 0.32 (RD7D8) -0.38 (RDK) -0.29 (POPK)	r2=0.41, F=17 chi-square=11 DW=1.92

According to Table 1, forest area in 1957 (FA57) is negatively related to road density (RDK), forest area in 1970 (FA70) is negatively related to road density and population density (POPK) and forest area in 1980 (FA80) is positively related to the increase in roads from 1970 to 1980 and negatively related to road and population density. All coefficients have the expected signs and the results indicate that forest cover is negatively related to human settlements.

In Table 1, road density appears in all three equations, population density in two and the increase in roads in one. Agricultural density does not appear in any of the equations. In addition to the fact that the variables are not the same for all three equations, it is of interest to note that the r-squares decline from .76 in 1957 to .58 in 1970 and .41 in 1980. To this study, this indicates the changing nature of the factors correlated with forest cover. The relative decline of the importance of road density indicates that the 1957 data may be capturing an early stage of frontier settlement and 1980 may represent a more mature phase. Roads, particularly large ones, may be important in opening up previously inaccessible areas and may have a greater effect on forest cover than smaller roads.

RESULTS OF THE PANEL ANALYSIS, 1970-1980.

In the panel analysis, the dependent variable is the absolute change in forest cover between 1970 and 1980. This variable is a direct measure of deforestation and is represented by DEFOR. The independent variables primarily represent changes in the variables used in the 1970 and 1980 cross sectional analyses. Since forest area in 1970 is strongly correlated with deforestation in the 1970 to 1980 period, two equations are presented; one with and one without forest area in 1970 as an independent variable. The results of the panel analysis are presented in Table 2 below.

TABLE 2: STATISTICAL RESULTS OF THE PANEL ANALYSIS, 1970-1980.

$$\begin{array}{lllll} \text{1) DEFOR} = 0.57(\text{FA70}) + & 0.17(\text{DIST}) + & 0.28(\text{DAGAR}) & & r2=0.65,\ F=42 \\ \quad N=67 \quad (7.1) & (2.2) & (3.3) & & \text{chi-square}=15 \\ & & & & DW=1.72 \end{array}$$

$$\begin{array}{lllll} \text{2) DEFOR} = 0.41(\text{DAGAR}) = & 0.23\ (\text{DRD}) + & 0.32(\text{LOG70}) & & r2=0.49,\ F=22 \\ \quad N=67 \quad (4.2) & (2.4) & (3.2) & & \text{chi-square}=17^{*} \\ & & & & DW=1.90 \end{array}$$

* p=.0479. As such, the .05 level of significance is not achieved.

Table 2 indicates that deforestation in the 1970-1980 period is positively related to forest area in 1970, distance from Manila (DIST), logging in 1970 (LOG70), changes in the area under agriculture (DAGAR) and changes in roads (DRD). The fact that deforestation in positively related to forest area in 1970 and, in fact, has the strongest correlation, is not surprising; those provinces with larger forests in 1970 experienced the greatest amount of deforestation in the 1970-1980 period. The other independent variables are of more interest.

It was suggested above that the distance variable represented the degree of control or, more properly, the lack of control that government officials were able to exercise over use of the forests; particularly logging and migration by poor farmers to previously forested areas. The importance of the distance variable in the panel analysis supports this interpretation; deforestation was positively correlated with distance from Manila. That deforestation in the 1970-1980 period is related to logging in 1970 confirms the verbal model of Philippine deforestation presented above also. In addition, given the suspicions this study has regarding the accuracy of the logging data, it is probable that the relationship would be even stronger if reliable data were available.

The positive relationship between deforestation and changes in agricultural area and road networks also supports the model presented at the beginning of this paper. Human settlements are expanding onto previously forested areas. Of interest is the fact that when the change in population from 1970 to 1980 is regressed against deforestation, the r-square is only .05. When the change in population density is regressed against deforestation, the r-square is only .02 and the result is not statistically significant. In short, the results of this study cannot support the contention of most scholars of tropical deforestation that increasing population is the leading cause of deforestation.

RESULTS OF THE PATH ANALYSIS

Given the complex nature of the deforestation process and the obvious correlations amongst some of the independent variables, it was felt that path analysis would be an appropriate technique to apply in an attempt to confirm the analysis presented above. The statistical work was done using the Linear Structural Relations (LISREL) program and path coefficients represent correlations between variables. Two models were analyzed and both are significant at the .05 level and the goodness of fit is greater than .97 for both.

In model #1, which includes forest area in 1970, the total correlations with deforestation, in order of importance, are as follows: forest area in 1970 (0.653), distance from Manila (0.269), change in agricultural area (0.242), change in population (0.213), change in roads (0.077) and logging in 1970 (0.034). The paths from logging in 1970 and changes in roads are not statistically significant. In model #2, which does not include forest area in 1970, the total correlations are as follows: distance from Manila (0.437), change in agricultural area (0.400), logging in 1970 (0.287), change in population (0.243) and change in roads (0.211). In model #2, all paths are significant.

Overall, the path analysis confirms the results of the panel analysis. The most important factors are forest area in 1970, distance from Manila, logging in 1970 and the expansion of human settlements as represented by changes in agricultural area, roads and population. The path analysis does not indicate that increases in population are the driving force of deforestation.

SUMMARY OF STATISTICAL RESULTS

The cross-sectional analyses of 1957, 1970 and 1980 revealed that forest cover across provinces was negatively related to road and population density. The panel analysis, on the other hand, with deforestation as the dependent variable, revealed that deforestation was positively related to forest area in 1970, distance from Manila, logging in 1970 and changes in roads and agricultural area. The fact that change in population and population density density was not important in explaining deforestation, indicates that the factor of overwhelming importance was the size of the forest resource and its control by government officials. The distance variable, in particular, is important since it appears to capture the notion of corruption and elite control of a public resource.

COMPARISON WITH OTHER QUANTITATIVE WORK ON TROPICAL DEFORESTATION

Quantitative work on tropical deforestation is limited; in fact, there are only three studies at the global level (Allen & Barnes 1985; Grainger 1986; Palo et al. 1987), one at the regional level for the Greater Caribbean (Lugo et al. 1981) and one at the sub-national level for Northeast Thailand (Panayotou & Sungsuwan 1989). Other than the present study, no national level analysis of tropical deforestation on a quantitative basis has been conducted.

Due to space limitations, it is not possible to compare in detail the present study with the five works cited above. As such, only the most important points raised by the present study will be discussed.

A major difficulty with multiple regression cross-sectional analyses dealing with nations is that the beta coefficients are virtually impossible to interpret since they represent an average of all the nations in the sample. Sample sizes of the cross-national studies listed above are as follows: Allen & Barnes (39 and 25), Grainger (30) Lugo et al. (29) and Palo et al. (60). As such, it is not clear how much, if anything, these studies tell us about an individual nation. The fear is that they may hide a great of variation amongst countries.

An equally troubling point is that three of the above studies (Lugo et al. (1981), Palo et al. (1987) and Panayotou & Sungsuwan (1989) have percentage forest cover as the dependent variable and not deforestation. In short, these researches are not about deforestation. The distinction between using forest cover or loss of forest cover is threefold: first, it can effect the r-squares of the statistical results (in the five studies noted above, the two that had deforestation as the dependent variable had r-squares from .11 to .52, while the three studies that had percentage forest cover as the dependent variable had r-squares from .60 to .77); second, it effects the choice of independent variables (if forest cover is the dependent variable, logging and forest area cannot be independent variables. In addition, if forest cover is the dependent variable, then the independent variables will most likely be density variables as opposed to change variables if deforestation is the dependent variable); third, at the conceptual level, there are reasons for assuming that the forces which determine forest cover are not the same as those determining rates of loss of forest cover.

The amount of forest cover remaining today is the end result of a process which may have started hundreds of years ago. The fact that forest cover today is negatively related to population density does not mean that population today is even an important explanatory variable of deforestation. Indeed, logically speaking, there are a priori grounds to assume that this is not the case. Deforestation occurs where forests exist and where forests exist population densities are generally low. Since density variables represent the sum total of human occupance, they tell us little about present day deforestation. A major conclusion of this study is that it is inappropriate to make statements regarding the process of deforestation based on an analysis of forest cover data alone.

This study raises some serious questions regarding the way the expansion of human settlements in the tropics and the resulting deforestation is conceptualized. The results of the panel analysis showed that increases in population are not important in explaining the variation in deforestation across provinces. The path analysis indicated that changes in population contributed to deforestation but they were overwhelmed by the influence of forest area in 1970, distance from Manila, logging in 1970 and changes in agricultural area. It is clear that population pressure per se does not result in deforestation, at least in the Philippines. This study is also of the opinion that the rapid rates of deforestation observed in, e.g., Malaysia, Indonesia and Brazil, are not the result of population pressure but, rather, reflect macro level decisions made by government officials. This result, which contradicts all of the quantitative studies mention above and most professional writing on the topic of tropical deforestation, necessarily means `that increased emphasis should be placed on the socio-economic context in which deforestation takes place. In the opinion of the author, the political economy of forest destruction is of utmost importance (Guppy 1984).

Lastly, the present research points out the need for more detailed case studies of tropical deforestation at the national level. In fact, given the attention that tropical deforestation has attracted, the lack of such studies is surprising. Such studies are needed to capture the uniqueness of each nation's deforestation process. Obvious differences which are of potential significance would include the physical nature of the country (mainland versus insular; topography), climate (presence or absence of a dry season), the presence or absence of commercial logging and the nature of the expansion of agriculture (e.g,, commercial versus subsistence). This study sees no reason why one grand theory of tropical deforestation should be appropriate for all countries.

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NEW BOOKS ON EUROPEAN FOREST HISTORY DURING THE EIGHTIES

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RESUME

Du grand nombre des nouveaux livres l'auteur a désigné d'abord ceux qui lui semblaient intéressants pour une meilleure compréhension des époques classiques de l'histoire européenne. C'est pourquoi il cite des livres adaptés aux besoins des jeunes savants, des sources importantes mais encore peu connues ou bien des livres traitant des pays représentatifs à cause de leurs efforts forestiers. De plus il a mentionné quelques titres ouvrant l'horizon du lecteur sur le cadre dialectique dans lequel se sont déroulées les victoires comme les défaites des forestiers ou de la forêt en général. De toute façon il semble que les problèmes du progrès forestier après la Révolution Française ont été le mieux compris par des auteurs de provenance française.

I. INTRODUCTION

Since there is not any central institution dealing with the problem of European forest history, there have been striking differences in the choice of subjects during the last decade. Glancing at the most important books I decided for a walk through the ages more than through the European regions; this way I hope to avoid boring repetitions and to underline concisely the most important problems, that is to say progress and decay of forests. Therefore I have to neglect books about minor countries and the Soviet Union as a whole, moreover treatises about short epochs or special fields such as hunting and environmentalism.

II. ANCIENT TIMES

The leading work is that of a renowned historian, Russell Meiggs from Oxford who published a book about "Trees and Timber in the Ancient

Mediterranean World" (1982). This is the first major systematic attempt to deal with a huge subject. Since the author served as a timber officer during World War II, he was able to discuss wood important for timber production, its trade and use in peace and war-time. Moreover the Lebanon, Athens and Rome are treated with special affection. We now learn more about the connection between demand and supply and the entanglement of necessities and neglection than before. The reader is very well instructed about the importance of timber for urban life. Eventually the legend of a strong deforestation during antiquity is reviewed and refuted by comparing classical quotations.

The current edition of Theophrastus' Plant History by a French botanist, Mrs. Suzanne Amigues, was prepared completely independent from Meiggs' book. Mrs. Amigues sacrifies her time for a critical textbook of the Greek original, accompanied by the French version (1988ss.). For students and young scholars the treatise of our member Jack Thirgood is representing a good introduction to the basic ecological problems, but his examples are more concerned with contemporary history than with antiquity (1981, cf. part V).

II. MEDIEVAL EPOCH

The French medievalist Roland Bechmann gave an introduction to the problems of forests and peasants' claims. The book has been reviewed in the JFH last year by Jean Jeanneney whom I agree with, as it concerns the advantages and disadvantages of Bechmann's work (1984). Less deductive and clearly arranged is the "History of English Forestry", written by Noel James at the occasion of the Centenary of the Royal Forestry Society (1982). James dedicates the first half of his memorial work to the complicated system of the English forest law from William the Conqueror to Queen Elizabeth I. Although James wrote an easily readable English, his book does not always convince: The timber profits of the English kings seem to be underestimated at the expense of the royal hunting, moreover the continental origin of the Forest Law in the Duchy of Normandy is completely neglected. Therefore the specialist agrees to the critical edition of the first volume of the Book of Hector of Chartres, Verderer of Normandy about 1400. Presented by Alain Roquelet we find a collection of all usufructs of Norman commoners during the Hundred Years' War (1984).

Besides of social and institutional history one may utilize the posthumous print of Hans Hausrath's history of German Sylviculture. There are meritory quotations, completed by Karl Hasel and his collaborators by an updated bibliography, but the style of Hausrath's manuscript does not seem adapted to foreigners' requirements because it was written during World War II, and there are excessively technical phrases (1982). So we still miss a book treating the problem of sewing and planting of trees from Roman to modern times.

IV. MODERN TIMES (XIVth to XVIIIth century)

Medieval institutions found their nucleus in the work of Norman dukes and then of English and French kings, they sought to realize high forests by severe laws and keeping regular accounts. However, Black Death and the Hundred Years' War finished the predominance of North-Western Europe. Since then economic necessities of Spain and Portugal have become more and more pressing, but there forests were combined with huge pastures, still united under the Roman conception of "montes", i.e. in English "mountains". During the reconquisition of the peninsula by the crusaders and then during the construction of colonial empires cattle and timber were needed at the same time. Erich Bauer-Manderscheid and Prof. Baeta Neves, both members of our group, are working on long-dated projects concerning Spain, respectively Portugal. Both have established that in spite of good institutions royal and community forests decreased at the profit of powerful pasture societies (1979; 1980; 1980ss.). Furthermore it is well known that the English realm in search of timber and char-coal lost most of its high forests, but German and French princes had taken care of deforestation in the time of Renaissance. These politics have been described by our late leaders Kurt Mantel and Michel Devèze. There was an important difference between the two countries: German regulations, timber trade and sylviculture developed on the way of decentralisation and fell into temporary oblivion by the events of the Thirty Years' War (1980), but French kings could accomplish a forest policy system by the Ordinance of 1669. However, this system required more social costs than Michel Devèze had thought. So Mrs. Andrée Corvol had to elaborate a tableau of French forest history between the declaration of the Ordinance and the Revolution. I think that her careful and impressive Thesis, published by the Paris University, is the best book on European forest history that has been written in the Eighties. There we learn a lot about the tensions at the forest borderlands , about the commoners' rights in general, we catch sight of foresters cleaning the ground from weeds and fighting for good oaks in the so-called high forest quarters and also the birth of the coppice-under-standards now becomes clearer for us. Eventually the situation was in a certain balance under King Louis XV, but after 1750 the growing population demanding more fire-wood than before finished as a battle lost by the forest administration when agriculture got more and more important (1984). So Mrs. Corvol described the dialectics between an only technically working administration and the peasants' daily needs.

In Germany Joachim Radkau and Ingrid Schäfer have meanwhile published a pocket-book concentrating on the wood as a primary resource, especially for the time of the proto-industrialization and the growing demand of wood and timber that outweighed the supply. The authors show many good figures of wood-working and wooden constructions, therefore this book seems well adapted to historians of technology and to students in general (1987).

V. CONTEMPORARY TIMES (XIXth and XXth century)

The achievements of the classical forestry of Germany may be checked with the help of a manual for students of forestry, written by Karl Hasel (1985). The author has divided the facts treating successively surface, property, legislation, administration, utilization, sylviculture and eventually the beginnings of forest science, all with respect to Central Europe. Thus the last chapters are the most useful ones for the foreign reader. Unfortunately Karl Hasel finished his book sometimes with the XIXth century, so the American scholars will miss the birth and progress of the soil rent theory of Robert Pressler. For people arriving from the Third World Franz Klose has written a treatise about mistakes and achievements of German forestry in English (1985). A student of Mediterranean problems may find vivid and critical suggestions in the treatise of Jack Thirgood. The problem of tensions between "Man and Forest" is especially engaged as a forester (1981). However, the scholar expecting more than surveys or case studies about contemporary developments has to compare at least two French books: Firstly Mrs. Corvol continued her Thesis in deepening her view about forest history dialectics by her broad survey about "Man in the forests" (1987). The contemporary State, born by the French Revolution, and especially the "Forest State" emancipated more and more from regional, agrarian life. The idea of a Forest State had been expressed before by our Deputy Leader, Gérard Buttoud, whose Doctoral Thesis has not been published. Buttoud studies the social nexus of foresters and forest owners in France due to his biographically founded research and the forest law. Mrs. Corvol deals more with the peasant society of French mountains. Overgrazing created a terrible danger under subtropical climates. On the other hand Mrs. Corvol "criticizes the Forest Administration for its insufficient appreciation of the social aspects of forest problems". This is a quotation from the reviewer of the Journal of Forest History published at Durham, N.C. last year. However, French foresters know how to defend their cause against environmental arguments from Paris. They have published a collective manual about the history of French forest administration from the XIIth to the XXth century (1987). Here the achievements of professional discipline are easy to follow, needless to say that the perpetuity of the State is nowhere stronger in Europe than in France. The reader has to choose his orientation beetween these two books. Personally I am admiring the style and the arguments of Mrs. Corvol as an author of excellent qualities, and I understand her deep love for the history of rural France always protected by its forests and subsisting by their support. Moreover "she calls for a new alliance based on lower-income urban dwellers" with the forest (quoted as before). But how can the State and its professional foresters or the private owners unify the different interests of all partners within a parliamentary democracy? These manyfold problems have been developed by the foresters specialised at Nancy College, as MM. Louis Bedré and Jean Gadant, in the framework of the history of French forest administration. Without forest science the path of modernization will not be open during the Nineties.

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HISTORY OF FORESTRY RESEARCH IN INDIA

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SUMMARY

Forestry Research in India, though started almost simultaneously with the introduction of systematic forest management around the middle of nineteenth century, developed slowly because of the constraints of financial and manpower resources. The changes in forest administration also influenced forestry research structure and pace of development. Important landmarks in forestry research development were the establishment of Forest Research Institute in 1906, decentralisation of silvicultural research in 1918, provincial autonomy in 1935, independence in 1947 and subsequent merger of Princely States, constitution of Indian Council of Forestry Research & Education in 1986 and establishment of Department of Forestry in some State Agricultural Universities to undertake forestry research and education during the last few years. Forestry research in the country is now receiving greater attention, but needs considerable strengthening.

Keywords: Forestry Research, history, India.

INTRODUCTION

Forestry research in India was initiated soon after the introduction of systematic forest management around the middle of nineteenth century. It was strengthened and reorganised to suit the changing administrative set up of forestry in the country. The research organisation was evolved according to the requirement of different regions and Provinces (States). The development of forestry research, consequently, varied from one to another State. Dealing with the history of forestry research for the entire country will, therefore, not be possible in this paper which discusses mainly the development of forestry research under Central Government.

DEVELOPMENT OF FORESTRY RESEARCH

Establishment and Growth of Forest Research Institute

The need for forestry research in India was felt almost simultaneously with the introduction of scientific management of the forests and the creation of forest service for the purpose. Forestry research began with the recording of observations by the Forest Officers, some of which were published and were made use of to initiate scientific forest management principles subsequently incorporated in the working plans. Vast amount of useful work done by individual officers could, however, not be properly documented and published and was lost. Concerted forestry research efforts can be traced back to the middle of Nineteenth century when Brandis proprounded the principle for yield regulation. As a result of the work initiated by some officers, monumental works such as Forest Flora of North-West and Central India by Brandis, Manual of Indian Timbers by Gamble and Indian Trees by Brandis were published between 1874 and 1906.

Though a beginning of the forestry research was made by forest officers serving in the field, it was realised that executive forest officers could not undertake specialised research work in the normal course of their duties. Laboratory forestry research in the country was accordingly started in 1878 when a small chemical laboratory was established in the Imperial Forest School started the same year at Dehra Dun. Scientific forestry research may be considered to have been started in 1901 with the appointment of the Forest Zoologist; this post was, however, abolished in 1903 (FRI 1961). The approach to forestry research was debated during 1904 and 1905 and the then Inspector General of Forests, S.Eardley Wilmot prepared a scheme which was approved by the Government of India. The Imperial Forest School was upgraded and reconstituted as the Imperial Forest Research Institute and College (referred to as FRI). Six professional posts with necessary support staff were provided at the beginning.

The staff of the FRI devoted greater part of their time for teaching leaving very little time for research. It was decided (Board of Forestry 1910) to involve executive forest officers in research work through sending circulars encouraging them to undertake research on various topics. Forest Rangers were regarded to be in a better position to carry on investigations in their areas (Anon. 1909). This approach did not work as the forest officers had little time or inducement to engage in research as their normal duties engrossed most of their time, and promotion depended on administration and financial capabilities. Identification of only those officers who might be interested in research and securing assistance of such officers was tried with a view to involve interested field officers in research who could later on join forest research under central or provincial government. This system also did not produce the desired results.

The FRI was strengthened and shifted to the new campus in 1914 where adequate laboratory and workshop facilities were provided. It was believed that the facilities created at the new campus would be sufficient for at least 20 years (Stebbing 1926). The First World War, however, put considerable demand on the research staff to ensure increased utilization of Indian timbers. Necessity arose for expanding forest research facilities, but the financial stringency at that time did not allow any strengthening. The Industrial commission accordingly stressed in 1918 the need for expanding forestry research and the Board of Forestry strongly supported this recommendation in 1919. Action to strengthen FRI and to shift it to a bigger campus (about 407 ha, named New Forest) was taken and the buildings were constructed and research disciplines were shifted between 1922 and 1929. The institute had, by then, grown to have 11 research disciplines. The FRI had hardly started in its new campus, when its functioning was affected by the world economic depression of early nineteen thirties and subsequently by Second World War. During this period, the forest utilisation research received priority and silvicultural research was continued only on maintenance basis. A reorganisation scheme to strengthen FRI was drawn up in 1945-46 and was approved by the Government for implementation in instalments. Strengthening was gradually done and new research disciplines were added. The number of research disciplines increased to 15 in 1950, to 22 in 1962, and to 24 in 1984.

Forestry Research in National Forest Policies

The Forest Policy enunciated in 1894 (Anon. 1894) laid down the principles which should underline the management of State forests in British India and did not deal with forestry research about which decisions were taken from time to time. The National Forest Policy of India framed in 1952 (Anon. 1952) after Independence dealt with forestry research very briefly. It was realised that forestry research under Government of India has to lean heavily upon the cooperation of State Forest

Departments, most of which had an organization of their own for the purpose. It was, therefore, stated that the maintenance of a research organization in each State, commensurate with its resources and requirements, was in the interests of efficient forest management of the country, but forest products research should continue to be with FRI.

The National Forest Policy, 1988 stated that with the increasing recognition of the importance of forests for environmental health, energy and employment, emphasis must be laid on scientific forestry research with particular emphasis on i) increasing the productivity of wood and other forest produce, ii) revegetation of barren/marginal/waste/mined lands and watershed areas, iii) effective conservation and management of existing forest resources, iv) research related to social forestry for rural/tribal development, v) development of substitutes for wood and wood products, and vi) research related to wildlife and management of national parks and sanctuaries (Anon, 1988).

National Commission on Agriculture

The National Commission on Agriculture (1976) examined forest research structure in the country and was of the view that forest research should be accepted as basic to efficient forest management and immediate attention was necessary to give new orientation to forestry research. The Commission, interalia, recommended i) that forestry research be grouped into forestry and biological research, industrial and utilization research, and forest management and operations research, ii) that the central government alongwith universities should coordinate and collaborate with the States in forestry research, iii) that the central government should, besides strengthening FRI, Dehra Dun, establish, where necessary, multi-disciplinary regional research institutes and specific problem oriented research centres, iv) that the state forest departments should primarily confine themselves to applied research on local problems and may, for this purpose, depending upon the magnitude of work, establish forestry research institutes, v) that agricultural universities should be increasingly involved in forestry research and vi) that the Council of Forestry Research and Education should be set up to promote and direct forestry research in the country.

Review of Forestry Research

The forestry research in the Central Sector was reviewed by various committees/panels, viz., Forestry Committee, 1929, First Expert Committee, 1956, Second Expert Committee, 1965, FAO Advisory Mission, 1977, Task Force of the Scientific Advisory Committee to the Cabinet, 1981 and Review Panel, 1985. Of the several recommendations made by these committees/panels, some of the important ones are : (Singh, 1985) i)forest research base should be strengthened and allocation for research should be enhanced, ii) Indian Council of Forestry Research & Education should be established and regional research centres be strengthened and upgraded to the level of the institutes,iii) FRI, Dehra Dun should be strengthened and given the status of deemed university, iv) forestry research should be funded in the universities also and close coordination between different organisations engaged in forestry research be ensured, v) the Central Government, State governments and universities should actively collaborate in forestry research, vi) forest-based industries and forest development corporations should also establish their research facilities, vii) research programmes should be problem-oriented and should be periodically reviewed to ensure relevance to national problems, viii) forest research workers in the country should be provided opportunities to benefit from overseas work, and ix) forest officers should be attracted to work for longer periods on research to ensure continuity and service conditions of the scientists should be improved to remove stagnation.

Forestry Research in States

In view of the large variety of climate and the forest types, silvicultural studies on different species were required to be conducted in representative areas. Decentralisation of silvicultural research, therefore, became necessary as regular observations in specific sites spread all over the country could not be recorded by FRI. The Board of Forestry recommended to start silvicultural research in the Provinces (Board of Forestry 1913). The Government of India considered in 1919 the possibility of decentralising forestry research and consulted the Provincial Governments (Provinces were named States after Independence). It was decided to maintain FRI under Central Government to provide some form of centralised coordination to avoid duplication and to ensure compilation and dissemination of research results (Howard 1922).

The provincial governments, however, emphasized that they should be free to carry out research of special and local interest and agreed that FRI should be responsible for more strictly scientific portion of research, for general guidance and coordination of investigations, and for the collection and distribution of information and the publication of results. Silvicultural research was accordingly taken up in the Provinces. It was started in 1918 in U.P., in 1919 in Bengal and Madras, in 1921-22 in Bihar, Orissa and Central Province and during 1927-30 in Assam, Bombay and the Punjab. Soon after the provincialisation of forest management in 1935, each province had its own organisation for forestry research.

The forestry research organization in the States grew very slowly. Some of the major States strengthened their research organisations and increased the number of silvicultural research divisions, the number of which depended on the size of the State and consequently the forest research requirements. In some States separate units for social forestry research have also been created with the implementation of social forestry programme. Kerala and Madhya Pradesh States have established State Forest Research Institutes.

Establishment of Regional Research Centres

Even though forest research had been initiated in the Provinces, but it was always the impression that the responsibility for forestry research was of the Government of India as the forest officers in the Provinces could not be expected to find time for research. The FRI could not meet the increasing research requirements of the country and its regional research centres were established in different parts of the country to look after regional research requirements. The regional research centres at Bangalore, Coimbatore, Jabalpur and Burnihat were established in 1956, 1959, 1972 and 1976 respectively. In order to strengthen the forestry research structure, research was undertaken on important forestry problems under coordinated research schemes, namely, research on minor forest products, forest soil-cum-vegetation survey, tropical pines, environmental problems, poplar, agroforestry, eucalypts, tree improvement and seed procurement, sandal and high level conifers.

Indian Council of Forestry Research & Education (ICFRE) Established

The forestry research structure in India remained inadequate to cope with the increasing research requirements. The Government of India accordingly established ICFRE in December, 1986 to strengthen, oversee and coordinate forestry research in the country. Besides FRI, Dehra Dun five new institutes have been established under ICFRE from April, 1988, viz., Institute of Forest Genetics & Tree Breeding, Coimbatore; Institute of Wood Science & Technology, Bangalore; Institute of Deciduous Forest, Jabalpur; Institute of Arid Zone Forestry Research, Jodhpur; Institute of Rain and Moist Deciduous Forest Research, Jorhat. The FRI, Dehra Dun will be developed as Centre of Excellence in the field of forestry research. The new institutes, other than the Institute of Wood Science & Technology, Bangalore, have been assigned an area of research at the national level and in addition, handle forestry research, other than forest products research, in the geographical region assigned to each of them. The Institute of Wood Science & Technology, Bangalore undertakes forest products research. Each institute is organised into Divisions according to the areas of research to be handled. The seniormost scientist incharge of a division is designated as Head Division and is responsible for research coordination and management. There is no separate extension organization in the institutes for the transfer of technology and this work is handled by the scientists.

Forestry Research in Universities

The universities did not normally undertake forestry research till very recently. The National Commission on Agriculture (1976) recommended participation of the universities in forestry research. Departments of Forestry have been established in 17 State Agricultural Universities (SAUs) during the last five years which undertake research in addition to undergraduate education. Some other universities also have now initiated forestry research. ICFRE is also funding forestry research in the universities.

Forestry Research in other Institutes

Forestry Research has also been started in some institutes of Indian Council of Agricultural Research (ICAR). All India Coordinated Research Project on Agro-forestry is being executed at 31 centres located at SAUs and ICAR institutes throughout the country. Central Pulp and Paper Research Institute, Saharanpur and Indian Plywood Industries Research Institute, Bangalore are the institutes under the Ministry of Industry, Government of India, and engaged in forestry research.

EVOLUTION OF FORESTRY RESEARCH STRUCTURE

Forestry research structure in India evolved with the forest management. In the beginning when the forests in British India were under the control of Central Government, the forestry research was also centrally controlled. Forestry research started to be decentralised consequent upon the transfer of forest management to the provinces. Some of the larger Princely States also constituted some sort of forestry research organization, but most of such States depended on FRI to meet their requirements. After Independence and merger of the Princely States, the Central Government as well as the State Governments maintained the research organization. The FRI, its regional research centres and coordinated research schemes constituted the research organisation under Central Government while each State had a silvicultural research set up mainly manned by foresters.

Structure of FRI, Dehra Dun

FRI when established in 1906, had six research disciplines,viz., Silviculture, Working Plans, Forest Zoology, Forest Botany, Forest Economics (Forest Products) and Forest Chemistry. During First World War, it became apparent that the organisation for forest products research was inadequate. Forest products research facilities were accordingly expanded and reorganised in 1920-21 to have seven sections, viz., Pulp and Paper, Wood Seasoning, Wood Preservation, Wood Technology, Wood Working, Timber Testing and service units of Mechanical Engineering and Wood Workshop (Aggarwal 1954). All the research disciplines were placed directly under the administrative control of the Head of the institute. The administrative structure of the institute was changed in 1952 by grouping the research disciplines into

Biological and Forest Products groups. In 1957, the research disciplines were grouped under six Divisions, viz., Mechanical Technology, Chemical Technology, Forest Botany, Forest Protection, Seasoning & Preservation and Forestry Research. The grouping into Divisions was replaced by Directorate system in 1962 when the research disciplines were grouped into three Directorates, viz., Forestry Research, Forest Products Research and Biological Research. The grouping of the research disciplines into Directorates had several disadvantages. Consequent upon the reorganization of FRI in 1988, Directorates were abolished and the research disciplines have been constituted into ten Divisions, viz., Silviculture, Resources Survey and Forest Management, Social Forestry, Genetics & Tree Breeding, Ecology and Conservation, Forest Protection, Forest Products, Forest Operations, Minor Forest Products, and Forest Botany.

CHANGING PERSONNEL POLICIES

In the initial years, the forest research staff was provided by posting suitable forest officers. In cases where suitable forest officers were not available, British specialists were appointed on contract, to organise such research sections and also to train the staff who could take over the duties after the expiry of contract of such specialists. Such an arrangement was, however, considered unsatisfactory by those who advocated that appointment on forest research posts should be made from amongst those who have necessary forestry training and background. Though some nonforesters were engaged as researchers but all the research disciplines (except chemistry) continued to be headed by forest officers till May, 1947. In the Provinces also, all the research posts were held by forest officers. After Independence in 1947, it became difficult to secure the services of suitable forest officers even for those research disciplines which could reasonably be headed by them because of the shrinkage in number of Indian Forest Service Officers due to the stoppage of recruitment to this service in 1932 and also as a result of large scale exodus of British Officers following Independence. These developments brought about a situation in which the forest officers with field experience became confined to silviculture and most of the remaining research disciplines were headed and manned by a very varied group of scientists without forestry background and indeed without any commonly shared background and thus posing a problem of losing not only the sympathy of the forest service constituting the most important target group for forestry research, but also of deviating the research into unrealistic channels. (Expert Committee 1956). The second Expert Committee (1965) emphasized that while it was not essential to post forest officers to head all the research disciplines, all those conducting forestry research must have adequate knowledge of practical forestry.

Arguments have been advanced since the very inception of forestry research in India in favour of and against recruiting research staff either from amongst the forest officers or from the scientists without any forestry training. The experience has shown that to make a good research worker in forestry, one should have received forestry training and should have some experience of working in the forests to have idea of the field problems. Short courses in forestry for scientists were always considered necessary, but the same could be arranged only during 1989 after the establishment of ICFRE. The courses in research methodology were arranged during 1936-38 and again during 1947-1950 for forest officers engaged on research. These courses have been revived in 1989 and are expected to be a continuous feature.

Separate Cadre for Forestry Research

The dichotomy in research staff between forest officers and scientists presented problems in research management in India. Constitution of a separate cadre in Imperial Forest Service for forest research was considered in 1910 (Board of Forestry 1910), but the same could not be done. In view of the difficulty of getting suitable forest officers for forest research consequent upon the transfer of control of the forests to the provinces in 1935, the Board of Forestry recommended in 1942 (Board of Forestry 1942) constitution of Fedral Central Forest Research Service. This recommendation was, however, not approved by the Senior Forest Officers Conference (Anon.1946) because it was felt that the forest officers, permanently seconded to such service might over long years of service in specialised posts, lose touch with realities of problems in forest management (Nicholson 1946). The Senior Forest Officers conference favoured giving better pay scales in forest research to attract suitable forest officers. Higher salary of forest officers comming on deputation to research posts and manning of senior posts mostly by forest officers resulted in dissatisfaction among the scientists. The proposal of creating a Central Forest Service for research having uniform pay scales for the scientists and the forest officers was revived from time to time, but the same did not get support from the forest service and also of the Expert Committee (1956) which felt that the weakness of such a service lay in the fact that its members would not have necessary field experience. The dichotomy in the forest research staff still persists and presents problems in research management in the country.

RESEARCH PROGRAMME MECHANISM EVOLVED

After the establishment of the FRI in 1906, the Government of India laid down the procedure for research programme formulation and approval (Anon 1907). The researcher at the FRI was required to draw up and submit the research programme well in advance to the President of the institute who was to obtain approval of the Inspector General of Forests for the entire programme of the institute before implementation. A copy of the approved research programme was sent to each Province so that necessary assistance in its execution might be secured. Forest Officers Conference decided in 1909 that the research programme of FRI would be triennial and that all Provincial Forest Departments should be consulted about the problems to be investigated (Miller 1910).

The Board of Forestry was constituted in 1910 to advise on the working of Forest Research Institute. The Board of Forestry was required to meet every three years. The Board in its meeting in 1925 constituted an Advisory Committee to assist the President, Forest Research Institute.

The Central Advisory Board on Forest Utilization was constituted in 1939 to consider the research programme of FRI and to assign priority to different items of research, to coordinate research with the needs of the industry, agriculture and general public and to forge a link between the producer, the consumer and the researcher. Later, the need was felt of effecting improvements in the formulation and execution of the research programmes and to ensure better coordination in research work. The Government of India accordingly constituted the Court of FRI in 1961 to be assisted by the Executive Council. Consequent upon the constitution of the Court, the Central Advisory Board on Forest Utilization was renamed as Advisory Board of Research. The Advisory Board of Research constituted six committees to review the research programme in the disciplines of silviculture, logging, timber engineering, forest utilization, biological research and pulp and paper (Expert Committee 1965).

Silvicultural Conferences

Consequent upon the decentralisation of forestry research in the country, a body of the silviculturists was created in 1918 with the representatives of silvicultural research from each Province and from FRI. This body of the silviculturists was created to coordinate silvicultural research work between provinces, to encourage the interchange of ideas and to ensure that standardised procedures were followed for research work. The silvicultural or statistical research programmes drawn up by the provincial silviculturists were to be discussed at the meeting of the Silvicultural Association. The Silvicultural Association had, however, no powers to modify the programme and could only suggest modifications which might prove useful. The research programme alongwith the suggestions of the Silvicultural Association, if any, required the approval of the Chief Conservator of Forests before implementation.

The Silvicultural Conference (meeting of Silvicultural Association) was to be held annually to discuss annual research programmes. Such conferences were, however, held at irregular intervals. It was later decided to hold silvicultural conferences quinquennially to coincide with the preparation and approval of quinquennial research programmes. The silvicultural conferences were actually held in 1918, 1922, 1929, 1934, 1939, 1945, 1946, 1951, 1956, 1961 and 1967. In the initial years, the silvicultural conferences discussed silvicultural research programmes, but subsequently, these conferences were utilised to present papers on the research work done and research programmes were not discussed. Finalisation of the research programmes was thus left to the provincial research organisations.

The Court of FRI decided in 1972 to replace silvicultural conference by Forestry Conference and Forest Products Conference to be held separately at 5 years interval. Forestry Conferences were held in 1973, 1980 and 1989 and the Forest Products Conferences in 1973 and 1986.

Research Programme Formulation Procedure Modified

The link between FRI and the users of research gradually loosened. The projects to be included in the research programme were identified on the basis of i) recommendations of silvicultural/forest products conferences, ii) visits of the research staff to the States or forest-based industries, iii) discussions between research workers, iv) ideas occurring to the research workers in the course of their work, and v) instructions from higher authorities (Expert Committee 1965). The procedure for identification of research problems did not work well. The recommendations of the silvicultural/forest products conferences could not provide the desired specific directions for research programme formulation. The research programmes did not, thus, always, take into account the requirements of the State forest departments and the forest-based industries.

Consequent upon the establishment of ICFRE and its institutes, the procedure for research programme formulation has been changed to ensure that the users of research are associated with research problem identification. National seminars are held to identify the research problems. Research Advisory Group (RAC) has been constituted for each institute having representatives from State forest departments, forest-based industries, farmers, besides eminent scientists from universities and research institutes outside ICFRE. The RAG identifies and prioritises different research items for the concerned institute. The progress of research project is periodically monitored within the institute. The RAG evaluates the progress at the end of the year.

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TECHNOLOGY TRANSFER AND EXTENSION IN WASHINGTON STATE, U. S. A.

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SUMMARY

Washington State University Cooperative Extension is the lead organization responsible for providing forestry technology transfer and extension programs in the state of Washington. The objective of the technology transfer and extension programs is that non-industrial private forest landowners, (NIPF) public and private forest advisors, and professional natural resource managers are obtaining and applying knowledge that will improve forest management practices, consistent with owner objectives, resulting in an increased flow of benefits including timber, wildlife, water, recreation, and range from Washington's nearly 18 million acres of commercial forestland. Educational programs and activities are conducted by a small cadre of county or area forestry agents and state forestry specialists. A variety of educational methods are used including: meetings, shortcourses, and tours; newsletters and written publications; mass media techniques; and response to individual requests. Just over 29% of the state's NIPF owners reported having received extension education or advice. The help received was rated good to excellent by 87% of the answers. Annually, over 2,000 professionals attend continuing education programs.

Keywords: Extension forestry, Cooperative Extension, non-industrial private forestry, technology transfer

WASHINGTON AND FORESTRY

The state of Washington is located on the Pacific Ocean in the Northwestern part of the United States. Washington is approximately 43 million acres (16.9 million hectares) in area and in 1989 had an estimated population of 4,700,000 people.

Approximately 54% or 23.2 million acres (9.1 million hectares) in the state of Washington are classified as forestland (Table 1). Of this total, 78% is classified as commercial forestland, 14% is non-commercial forestland, and the remaining 8% is referred to as "productive reserved" or lands withdrawn from commercial timber use and set aside in wilderness areas or national parks.

The percentage breakdown of commercial forest is as follows: national forest 29%, state and other public 23%, forest industry 24%, and non-industrial private forest 25% (Table 2).

Forestry and the forest products industry are vital to the state's economy. In 1987, over 7 billion board feet of timber was harvested in Washington (Larsen 1988). Total employment in the state's forest products industries was 55,600 workers in 1987 (Warren 1989). The 1988 gross business income for the Washington forestry and forest products sector was over $9 billion (CINTRAFOR 1989).

Table 1: Washington Forest Area by Forestland Classes 1977. (Thousand Acres)

Forestland Class	Western Washington	Eastern Washington	Total Washington
Forestland	12,607	10,574	23,181
Commercial Forestland	9,788	8,134	17,922
Non-Commerical Forestland	1,645	1,552	3,197
Productive Reserved	1,024	720	1,744
Productive Deferred	150	168	318

Source: USDA, Forest Service, Forest Statistics of the United States, Review Draft, 1977.

Table 2: Commercial Timberland in Washington by Region and Ownership, 1977. (Thousand Acres)

	Total of All Land	Commercial Timberland	National Forests	State	Other Public	Forest Industry	Farm Forests
Western Washington	15,694	9,788	2,200	1,358	43	3,581	2,216
%	37	55(a)	22	14	4	[illegible]	[illegible]
Eastern Washington	26,762	8,134	2,967	726	1,510	738	2,193
%	63	45(a)	36	9	19	9	27
Total Washington	42,456	17,922	5,167	2,084	1,943	4,319	4,409
% (b)	100	100	29	12	11	24	25
Percent Change (1962-77)		-5	-7,6	-0,8	-5,5	0,4	-7,6
United States	2,263,548	487,726	89,007	23,642	23,953	67,976	283,148
%		100	18	5	5	14	58

(a) Percent of Washington Total by Region
(b) Percent of Washington Total by Ownership

COOPERATIVE EXTENSION

Washington State University Cooperative Extension is a three-way partnership among the U.S. Department of Agriculture, Washington State University, and county government, all sharing, planning, and financing extension work. Cooperative Extension conducts technology transfer and extension programs to disseminate and to encourage application of research-generated knowledge.

Extension forestry is a relatively small component of Cooperative Extension which offers educational programs in five major areas: 1) agriculture, 2) natural resources, 3) family living and home economics, 4) youth, and 5) community resource development.

To understand Extension in the U.S., two aspects are particularly important: 1) Extension is unique among public agriculture and natural resources programs because it considers the objectives of the individual farmer and forest owner before all others. It works with the owner to identify management alternatives that are in his or her best interests, recognizing that the side benefits will be more productive farms and forest resource bases, and a stable raw material supply for industries (Baughman et al. 1985).

2) Extension in the U.S. is administered at the state level by land-grant universities such as Washington State University. This means that most Extension professionals are members of an academic institution rather than a straight-line government agency. Extension forestry in other countries is administered by a government agency such as a national forestry agency (Young 1986).

RELATIONSHIPS TO OTHER ORGANIZATIONS

Forestry education and technical assistance programs are available to Washington's forest landowners from a variety of public and private sources. While Washington State University Cooperative Extension has the lead role in providing forestry educational programs, several other agencies and organizations also provide help of various kinds to forest owners. The Washington Department of Natural Resources provides free on the ground technical management assistance to landowners, while the U.S. Soil Conservation Service provides technical assistance in developing resource management plans. The Agricultural Stabilization and Conservation Service administers, on a cost-sharing basis, incentive payments for practices that conserve forestland resources and assure future productivity. In the private sector, consulting foresters offer a wide range of independent forest [illegible] forest. The tree farm system is sponsored by forest industry as a means of recognizing, publicizing, and encouraging the management of private forestland. Also, there are state and national landowner associations which promote sound management through local meetings, newsletters, and field trips.

These organizations tend to be different in function and purpose, but are generally supportive of each other. Duplication is minimal and cooperation is strong. NIPF owners commonly receive assistance/education from more than one source, reflecting the fact that these programs do work as a system, with each part having a different function.

FORESTRY TECHNOLOGY AND EXTENSION

Rationale and Issues

We estimate that there are over 45,000 non-industrial private forest owners, NIPF, with 20 acres of commercial forestland or more in the state of Washington. Most NIPF owners have limited knowledge and skills necessary for proper management and marketing. And in many instances, even awareness of need for management and marketing information is lacking. Few landowners intensively manage their lands. Particularly on smaller acreages, many owners own their land for non-timber purposes. Intensive management could significantly increase yields of timber from Washington's NIPF lands. The challenge is to educate those interested in intensive management to the proper techniques and, at least, to educate those not interested in intensive management how to best manage for their objectives while still producing timber for the state's economy.

Other important issues include: reducing non-point source pollution; the production and marketing of Christmas trees, special forest products, and other alternative crops; agro-forestry; marketing of timber, including foreign markets; wildlife enhancement; and small scale management techniques.

The knowledge and abilities of NIPF owners varies greatly; therefore, the role of public and private forest advisors such as county agents, state farm foresters, and private forestry consultants is very important in helping ensure proper forest management. Because forest advisors play a vital role in providing advice and technical assistance to NIPF owners, it is critical that they are up-to-date on current forestry and research practices.

Seventy-five percent of the state's commercial forestland is directly managed by professional foresters. Rapid technological advances, increased resource demands and tightening environmental constraints are causing obsolescence of the professional natural resource manager's knowledge. Cooperative Extension is looked to for leadership in technology transfer, continuing education, and for aiding in research implementation.

In Washington, the following are major issues that are addressed through technology transfer and extension:

1. Public Awareness—Forest owners, policy makers, and the general public, including youth, could be better informed to understand and appreciate the economic and environmental role of forestlands in contributing to local state and national needs.

2. Policy Education—Education of forest owners and managers could enable them to better understand and participate in the development of local, state, and federal forest policies.

3. Program Coordination—Improved coordination among organizations and professionals who provide education, assistance, and research programs for forest owners can reduce duplication of services and improve the efficiency of available programs.

4. Professional Education—Continuing education for natural resource professionals, including managers and advisors can enable them to better put latest technology into practice.

5. Forestland Management—Improvements can be made in forest management and the marketing, harvesting practices, and utilization of timber, Christmas trees, and other special forest crops. Wildlife, watershed protection, aesthetics, forested range, and windbreaks can be enhanced through proper practices.

Objective

The objective of forestry technology and extension programs conducted by Washington State University Cooperative Extension is that forest owners, forest advisors, and professional natural resource managers are obtaining and applying knowledge that will improve forest management practices, consistent with owner objectives, resulting in an increased flow of benefits including timber, wildlife, water, recreation, and range from Washington's forestlands.

Educational Methods

Educational programs include shortcourses, conferences and tours which focus on topics including timber and non-timber objectives. Stand establishment, management, business management, forest products marketing, forest protection in timber harvesting, wildlife enhancement, and other topics are addressed. County agents have the lead role in conducting local programs specific to the needs of their clientele. Often, programs are conducted in conjunction with other organizations and agencies, such as the Washington Farm Forestry Association, the Washington Department of Natural Resources, and the U.S. Soil Conservation Service.

A forestry newsletter is mailed to about 8,000 NIPF owners and interested individuals four times a year. The newsletter provides current information and helps create awareness of the need for the proper forestry practices as well as information on sources for help. Current marketing information and prices are also provided.

Printed and other audio visual materials are used to provide forest management information on subjects including subjects stand establishment and management, forest protection, business management and marketing, and timber harvesting.

Mass media techniques including radio and television are used. Equipment is now in place to conduct satellite linked teleconferences throughout the state.

Extension agents and specialists respond directly to inquiries and requests for information and advice. One-on-one education is common when individuals have specific needs. Extension agents and specialists often work directly with other university faculty and agency researchers in answering requests for information.

Resources Involved

Professional resources involved in conducting forestry technology transfer and extension programs are modest and include only two state extension foresters, one extension forestry project associate, and five county or area agents with professional forestry educations, but with additional non-forestsry educational responsibilities, and eleven generalist agents with educational degrees in other subjects such as horticulture, animal science, etc. Most intensive NIPF programs are concentrated in twelve of the state's 39 counties while professional manager programs cover a statewide audience. A dozen or more public and private associations cooperate with extension in providing programs for target audiences. Many educational programs are facilitated by an extension agent or specialist and actually taught by university faculty or other scientists. Program delivery is at its limit due to the small number of forestry educated personnel. Additional staffing would result in more owners and managers benefiting from technology transfer and extension programs.

Results

In the calendar year 1986, NIPF technology transfer and extension programs resulted in the following: a) Fifty educational programs with 2,000 attendees, including 800 forest owners holding over 80,000 acres. Approximately 70% of the owners responding to surveys said that they learned information that would enable them to better manage their forests; b) Four editions of the forestry newsletter was mailed to 8,000 addresses for 32,000 annual mailings. A reader survey indicates: 1) over 20,000 readers with 98% having learned some or much new information; 2) 80% of readers own forestland totaling over 750,000 acres; and 3) as a result of the newsletter, 25% of the owners have started or changed a forestry practice and 57% will do so in the future; c) An estimated 1,700 individual requests for advice or information were answered.

Nine hundred ten (910) NIPF owners responded to a 1988 random mail survey and indicated that 9.8% of the respondents had attended an extension educational meeting, 17.3% had received individual agent advice or information, and 23.2% had read extension forestry newsletters or other publications. In total, 29.3% of the NIPF respondents indicated that they had received one or more forms of extension education or advice. The education or advice received from extension was rated as good to excellent by 87.2% of the NIPF owners.

For the calendar year 1988, 2,500 professionals from Washington and other states attended 25 educational programs which included computer applications, silviculture, forest pest management, policy, NIPF management, soil management, harvesting, genetics, and economics. Over 90% of the participants surveyed said they learned new information related to their work; over 85% taking written pesticides exams passed; all silviculturists passed written exams.

For the sixteen month period of January 1986 through April 1987, Washington State University Cooperative Extension agents and specialists conducted or helped facilitate 51 professional natural resources programs, including forestry, for 6,839 foresters, range managers, wood technologists, wildlife biologists, and other natural resource professionals. These programs total 860 hours of instruction for 81,670 contact hours of technology transfer. To put this in perspective, it is the equivalent of over 5,444 university semester credits or 363 full time university students for one semester.

CONCLUSION

Forestry is extremely important in the state of Washington. Washington State University Cooperative Extension technology transfer programs are effectively addressing a wide range of forestry issues and educational needs, but more landowners and managers could be reached if staffing were increased. Extension forestry programs function as part of a de facto system of public and private organization providing education and assistance in Washington.

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ISSUES AND PRIORITIES IN FOREST RESOURCES EXTENSION IN THE NORTHEASTERN UNITED STATES

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RESOURCE BASE

Within the twelve state Northeast Region, extension professionals in forest resources are challenged by the highest concentration of forest lands and forest landowners of any region of the United States. The presence of many of the nation's largest population centers often overshadows the fact that almost two thirds of the land area of this region is covered with forest. While the Northeast comprises less than 6 percent of the land area of the United States it contains 16% of the nation's commercial forest land, 20% of the nation's private forest land and 30% of the private forest landowners (Table 1). The predominantly hardwood forests of the region are maturing following the heavy logging of the 19th century. Today there is more land covered with forest (83 million acres) in the northeast than at any time during the last 100 years.

ECONOMIC IMPORTANCE

The region's forests are vital to the recreational and tourist industries of the Northeast. The Northeast along with having more people per square mile also has the highest concentration of hunters, fisherman, hikers, campers and bird watchers of any region in the country. Millions of dollars are spent annually in pursuit of these activities. The colorful foliage of the hardwood forests each autumn provides a tremendous economic benefit to many rural areas within the region. Forest provide habitat for over 122 species of birds and 50 species of mammals. The value of forested watersheds in providing clean water for recreation and domestic use for millions of residents and tourists may be immeasurable in economic terms, and the protection of the region's water supply promises to be a priority resource issue in the 1990's and beyond.

Wood derived from the Northeast forest supports a substantial forest products industry employing over 350 thousand individuals with an annual payroll exceeding $4.6 billion and value added by manufacture exceeding $10

TABLE 1. Forest Land Area Northeastern US

	Land (M acres)	Total Forest (M acres)	Total Forest (%)	Commercial Forest (M acres)	Industry (M acres)	(%)	NIPF (M acres)	(%)	Public (M acres)	(%)
Connecticut	3,082	1,861	60%	1,808	0	0%	1,659	92%	149	8%
Maine	19,729	17,718	90%	16,951	8083	48%	8,327	49%	541	3%
Massachusetts	5,007	2,952	59%	2,797	30	1%	2,402	86%	365	13%
New Hampshire	5,731	5,014	87%	4,692	947	20%	3,165	67%	580	12%
Rhode Island	664	404	61%	395	0	0%	363	92%	32	8%
Vermont	5,907	4,512	76%	4,430	666	15%	3,342	75%	422	10%
New England	**40,120**	**32,461**	**81%**	**31,073**	**9726**	**31%**	**19,258**	**62%**	**2,089**	**7%**
Delaware	1,233	392	32%	384	30	8%	340	89%	14	4%
Maryland	6,289	2,653	42%	2,522	139	6%	2,141	85%	242	10%
New Jersey	4,775	1,928	40%	1,857	16	1%	1,522	82%	319	17%
New York	30,357	17,218	57%	14,489	1,180	8%	12,417	86%	892	6%
Pennsylvania	28,592	16,826	59%	15,856	964	6%	11,489	72%	3,403	21%
West Virginia	15,335	11,669	76%	11,484	880	8%	9,483	83%	1,121	10%
Mid Atlantic	**86,581**	**50,686**	**59%**	**46,592**	**3,209**	**7%**	**37,392**	**80%**	**5,991**	**13%**
Northeast	**126,701**	**83,147**	**66%**	**77,665**	**12,935**	**16%**	**56,650**	**73%**	**8,080**	**10%**
Northcentral	500,000	96,498	19%	91,538	5,022	5%	63,047	69%	23,469	26%
South	510,000	207,072	41%	188,433	35,754	19%	134,937	72%	17,742	9%
West	1,126,000	352,232	31%	128,521	14,444	11%	26,536	21%	87,541	68%
Total US	2,262,701	738,949	33%	486,157	68,155	14%	281,170	58%	142,823	29%
Northeast % Total US	**5.60%**	**11.25%**		**15.98%**	**18.98%**		**20.15%**		**5.66%**	

billion dollars annually (Table 2). Primary producers in the Northeast annually process over 4 billion board feet of sawtimber and 12 million cords of roundwood each year. Furthermore, the energy crisis of the Seventies has resulted in a large percentage of the households within the region also utilizing over four million cords of wood each year as a source of fuel in home heating. The Northeast is generally not noted for the prominence of its forest products industry. However, given the small size of the land base, the economic importance of this industry fairs surprisingly well when compared to other regions of the country (Table 2). In terms of dollars per square mile of land area it could be argued that the Northeast is one of the most productive areas in the country.

Much of the forest in the Northeast will be maturing in the next 25 years. If properly managed, these forests are capable of reaching sustainable high levels of production which can result in double or triple the current harvest. There is the potential to raise the income to landowners, double the primary processing work force, and stimulate the establishment and expansion of secondary wood based industries throughout many rural areas in the Northeast that are in need of economic revival. The forest of the Northeast are currently an undervalued asset to the regions economy, but it will take new initiatives in research, assistance and extension education to wisely capture their full potential.

The species composition of the northeastern hardwood forest is complex. Most stands are made up a mixture of species which vary substantially in stem form and wood quality. The economic value of these stands is more dependent on species composition and stem quality than on the total volume of timber present. Currently, annual growth of all tree species within the region continues to exceed the amount cut. While total biomass of wood is more than sufficient to meet future needs, there is concern about the decreasing supply of high-quality hardwoods. The demand for fine hardwoods is continuing to increase and prices for many species are at an all-time high. There is a definite need to develop and expand markets for lesser quality hardwoods which occupy much of the land, to provide incentive for private forest landowners to manage for quality hardwoods.

NON-INDUSTRIAL PRIVATE FOREST OPPORTUNITIES

Over 70% of the regions forestland is controlled by 1.8 million non-industrial private landowners. With the exception of Maine, the forest products industry does not control a substantial percentage of the forest land in any state and public forest ownership averages less than 10% for the region. The private forestland owners within the Northeast are a diverse group. Less than three percent of the owners are farmers while almost 40% are white collar workers and over 25% are retired. Many landowners do not live on or near their property, and they may not even live in the same state. These owners are often well-educated, but have little understanding of natural resource management.

Most forest landowners cite recreation, aesthetics, and land investment, or the fact that forestland is part of residence or farm as the main

TABLE 2. Economic Importance Forest Products Industry Northeastern US

	Private Owners (thousands)	FP Industry Employees (thousands)	FP Industry Payroll (million)	Value Added Total (million)	Capital Expenditure (million)
Connecticut	50.00	12.3	$172	$377	$31
Maine	107.00	30.3	$451	$1,082	$317
Massachusetts	103.90	44.6	$569	$1,155	$77
New Hampshire	90.00	13.3	$164	$352	$27
Rhode Island	14.00	3.1	$39	$75	$6
Vermont	77.30	9.4	$97	$221	$20
New England	**442** *668*	**113**	**$1,491**	**$3,263**	**$477**
Delaware	7.50	0.9	$5	$12	$12
Maryland	95.80	17	$196	$442	$15
New Jersey	63.60	45.7	$616	$1,325	$107
New York	506.50	88.2	$1,084	$2,272	$139
Pennsylvania	490.10	82.3	$1,073	$2,621	$231
West Virginia	207.50	6.2	$59	$147	$2
Mid Atlantic	**1,371** *1726*	**240.3**	**$3,034**	**$6,819**	**$505**
Northeast	**1,813** *2,394*	**353**	**$4,526**	**$10,082**	**$982**
Northcentral	1,389	435	$5,759	$12,863	$1,121
South	2,194	658	$7,413	$17,639	$2,412
West	321	402	$5,227	$11,838	$1,140
Total US	5,717 *7,757*	1,848	$22,925	$52,422	$5,655
Northeast % of US	**32%** *31%*	**19%**	**20%**	**19%**	**17%**

TABLE 2A. Economic Importance Forest Products Industry Northeastern US

	Payroll			Value Added		
	Lumber&WP millions	**Pulp&Paper** millions	**Furniture** millions	**Lumber&WP** millions	**Pulp&Paper** millions	**Furniture** millions
Connecticut	$10.60	$115.80	$45.10	$14.30	$278.30	$84.40
Maine	$157.60	$293.40	$0.00	$282.30	$800.10	$0.00
Massachusetts	$55.40	$422.00	$92.00	$108.00	$853.40	$194.00
New Hampshire	$47.40	$101.50	$14.60	$113.70	$206.70	$31.50
Rhode Island	$6.10	$32.50	$0.00	$9.90	$65.00	$0.00
Vermont	$36.80	$35.50	$25.10	$81.50	$92.90	$46.70
New England	$313.90	$1,000.70	$176.80	$609.70	$2,296.40	$356.60
Delaware	$3.80	$0.00	$1.30	$7.60	$0.00	$4.10
Maryland	$24.30	$135.70	$36.20	$46.20	$338.40	$57.50
New Jersey	$65.40	$446.90	$104.10	$123.70	$1,016.00	$185.70
New York	$152.80	$656.20	$274.90	$308.10	$1,437.70	$526.30
Pennsylvania	$230.70	$598.70	$243.90	$488.90	$1,619.70	$512.30
West Virginia	$44.50	$14.80	$0.00	$99.70	$35.80	$11.50
Mid Atlantic	**$521.50**	**$1,852.30**	**$660.40**	**$1,074.20**	**$4,447.60**	**$1,297.40**
Northeast	**$835.40**	**$2,853.00**	**$837.20**	**$1,683.90**	**$6,744.00**	**$1,654.00**

TABLE 2A. Economic Importance Forest Products Industry Northeastern US

		Capital Expend.	
	Lumber&WP	**Pulp&Paper**	**Furniture**
	millions	millions	millions
Connecticut	0.3	28	2.2
Maine	35.2	281.6	0
Massachusetts		77	
New Hampshire		26.9	
Rhode Island		5.8	
Vermont		19.9	
New England	**35.5**	**439.2**	**2.2**
Delaware	7.6		4.1
Maryland	14.7		
New Jersey		106.8	
New York		118.7	20
Pennsylvania	72.6	139.8	18.6
West Virginia		2.2	
Mid Atlantic	**94.9**	**367.5**	**42.7**
Northeast	**130.4**	**806.7**	**44.9**

reason for owning property. Most of the forestland is not being managed for any use. Landowners generally are unaware of the management opportunities which exist, and over half do not know how to get forestry information or professional assistance.

The market value of forestland varies widely within the region. Throughout the 1980's, land prices across New England and the mid-Atlantic states (Maryland, Delaware, New Jersey) rose dramatically, a result of increasing populations, strong economies and the resultant development pressures. Issues surrounding the loss and fragmentation of the forest resource base have become increasingly important in these areas. On the other hand, the depressed economies in parts of Pennsylvania, West Virginia and New York caused land values to decline or remain stable, and increased the need to revitalize these rural economies, including their forest products industries.

Throughout the region, many landowners continue to look to their forestland as a source of income. Large numbers of landowners, particularly those with larger acreages, have sold and are selling timber. Unfortunately, much of the timber harvesting on private lands is done in a manner which does not maximize benefits to the landowner or society. Professional forestry assistance is involved in less than 15 percent of all timber sales. Little, if any, long-term planning is carried out and the future productivity of the land is rarely considered. This often results in diameter limit cutting, high-grading, and a substantial decrease in the quality and productive value of the forest.

EXTENSION STRUCTURE AND RESOURCES

The typical Cooperative Extension staffing structure within a state consists of specialists in forestry and wildlife on the faculty at the land grant universities, with field educators located in county offices. On average, there are fewer than three forestry specialists per state in the region, and in most states few if any field staff have forestry backgrounds. This works out to some 25,000 woodland owners, 10,000 industry employees, and 3 million acres of forestland for each extension specialist with the region. While this level of staffing is clearly inadequate, federal budget deficits, coupled with limited fiscal resources in most states, make significant increases unlikely in the foreseeable future.

Traditionally, state extension programs have operated largely independently of one another. Among the northeast states, however, considerable similarities exist in forest vegetation, landowner demographics and the forest based industries. Further, many specialists have training and talents which compliment those of their counterparts in neighboring states. For these reasons, multi-state extension programming has been much more common in the northeast than in other regions of the country.

TABLE 3. Forest Growth Statistics Northeastern US

	Hardwood Growth (million cu ft)	Hardwood Removal (million cu ft)	Softwood Growth (million cu ft)	Softwood Removal (million cu ft)	Total Growth (million cu ft)	Total Removal (million cu ft)	Growth/ Removal (Ratio)
Connecticut	65,230	14,592	16,593	2,175	81,823	16,767	4.88
Maine	166,072	147,157	576,906	298,980	742,978	446,137	1.67
Massachusetts	88,376	16,335	53,430	19,019	141,806	35,354	4.01
New Hampshire	136,049	41,286	136,049	41,286	272,098	82,572	3.30
Rhode Island	9,428	2,653	7,931	376	17,359	3,029	5.73
Vermont	61,682	34,869	47,291	33,802	108,973	68,671	1.59
New England	**526,837**	**256,892**	**838,200**	**395,638**	**1,365,037**	**652,530**	**2.09**
Delaware	16,006	5,119	3,966	6,071	19,972	11,190	1.78
Maryland	86,100	42,674	24,900	2,081	111,000	44,755	2.48
New Jersey	22,063	6,776	4,950	5,141	27,013	11,917	2.27
New York	215,989	117,648	85,590	46,855	301,579	164,503	1.83
Pennsylvania	799,377	232,027	48,567	13,183	847,944	245,210	3.46
West Virginia	426,605	155,889	61,098	10,887	487,703	166,776	2.92
Mid Atlantic	**1,566,140**	**560,133**	**229,071**	**84,218**	**1,795,211**	**644,351**	**2.79**
Northeast	**2,092,977**	**817,025**	**1,067,271**	**479,856**	**3,160,248**	**1,296,881**	**2.44**

NORTHEAST FOREST RESOURCES EXTENSION COUNCIL

Seeing both the opportunity and the need for greater regional cooperation, the Northeast Agricultural and Natural Resources Extension Program Leaders decided in 1983 to formalize a regional extension forestry committee. Called the Northeast Forest Resources Extension Council (NEFREC) the group consists of one extension specialist in renewable natural resources from each of the twelve northeast states. The National Extension Forestry Program Leader and a liaison from the U. S. Forest Service's State and Private Forestry division are regular attendees at meetings. NEFREC's primary mission is "to identify, prioritize and design programs which address emerging issues of critical regional importance involving renewable natural resources".

In the seven years since its formation, NEFREC has developed a significant record of accomplishment in improving regional cooperation and efficiency. It has provided a vehicle through which specialists can assist in the development of their colleagues' programs, and extend the results of those efforts across the region. NEFREC maintains a complete bibliography of the region's Extension publications in renewable resources, and uses these data to identify publication needs as well as areas where duplication exists. It has completed two surveys of practicing foresters' research needs and developed forestry research agendas for the northeast for distribution to the research community. It has greatly improved cooperation and communication between Extension and other agencies/organizations involved in forestry in the region. It has successfully conducted a conference for absentee woodland owners in Washington, D.C. who own land in the northeast region, and is currently involved with three other regional conferences involving the education of loggers, the management of volunteers in renewable resources education programs, and conservation biology.

EMERGING ISSUES OF IMPORTANCE

In 1989 NEFREC conducted a two stage survey of its members and their Extension colleagues to identify key emerging issues of regional importance. the survey identified fourteen issues of regional importance which NEFREC might address. Of those, one issue received a significantly higher rating than the others, and was embodied in this issue statement:

> "Increasing urban and suburban development is expanding into areas that were traditionally rural. As a result, potential areas of conflict among water, forestry, wildlife and other land uses are expanding at this urban/rural interface.
>
> In light of this trend, new approaches to non-industrial private landowner assistance must be explored. These include non-traditional income opportunities, estate planning, private tools and options for conserving undeveloped land, and the importance of stewardship."

In other words, NEFREC members foresee a continuation of rising land values and increasing competition for and demands upon the fixed forest resource base. They foresee a region in which broad land use decisions and regulation at both the state and local level will increasingly dictate the future quality and productivity of forest and wildlife resources. And they foresee a landowner clientele who's information needs go beyond traditional management and marketing and into the arenas of long term land use decision making and even public policy.

Already, regional extension programming reflects these expanding needs. Estate planning programs targeted to woodland owners are offered in several states. In New York a major regional symposium will be held this fall on the application of conservation biology and landscape ecology in land use decision making. In Connecticut and Massachusetts, programs which document the economic, environmental and social values of forest resources for land use planners have been underway for some time. NEFREC continues to provide a forum for the regional development of such programs and the exchange of needed resources.

In summary, the northeastern United States is a region where forests, wildlife and people interact intensely. Millions of urban and suburban dwellers have strong opinions on how these resources should be used, but little understanding of natural ecological processes and/or their dependence on them. These societal forces, manifested through land use decisions and regulation, promise to be the dominant force shaping the region's forest of the future.

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JAPANESE AND U.S. FORESTRY COOPERATIVES: A STUDY IN CONTRAST[1]

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SUMMARY

Forestry landowner cooperatives in the U.S. and Japan are examined and contrasted. The history, organization, membership profile, activities and management, and finances of each country's forestry cooperative organizations are described. Requirements for successful activity of U.S. cooperatives are identified.

Keywords: Forestry cooperative, NIPF owner, Japan

INTRODUCTION

For centuries, people have worked together to accomplish what as individuals they could not. In modern times, we have named these working groups "cooperatives." All kinds of cooperatives exist, relating to everything from water and childcare to agricultural products. It is not surprising then that owners of forest land would form cooperatives. This paper presents an overview of forest owners' cooperatives in two countries where very different situations exist. In Japan, forest owners' cooperatives are very active, strongly supported by members, and, by most measures, generally highly successful. In contrast, U.S. forest owners' cooperatives are much less active, much less prevalent, and by nearly all measures much less successful.

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In this paper, the focus of ownership will be on the private, nonindustrial forest (NIPF) owner. Hereafter, forest owners' cooperatives will be referred to as "cooperatives" or "forestry cooperatives." They are usually thought of as user-owned and democratically controlled businesses from which benefits are received in proportion to the use of services (Ingalsbe and Kirkman 1988).

U.S. COOPERATIVES

History

Nationally, the cooperative movement began in 1752 when Benjamin Franklin helped organize the country's first cooperative, the Philadelphia Contributionship for the Insurance of Homes from Loss of Fire (Ingalsbe 1989). Forestry cooperatives are not so old, however, dating back to 1910 (Digby and Edwardson 1976). They received considerable interest between 1920 and 1940 during the height of agricultural cooperative development.

Based on a review of the literature about forestry cooperatives and interviews with several current and former cooperative managers, performance of today's cooperatives on a national-level can only be described as bleak. With 7.8 million NIPF owners controlling nearly 120 million ha, 58% of the nation's forest land, one might expect the potential for cooperatives to be much greater than the actual situation reflects (Birch 1986).

There is no organization that represents or coordinates forestry cooperatives nationally or even regionally. In contrast, agricultural cooperatives have a national association, the National Cooperative Business Association, formed in 1916; a Federal support organization, the Agricultural Cooperative Service, formed in 1926; and a financial organization, the National Cooperative Bank, formed in 1978 (Ingalsbe 1989). Nonetheless, forestry cooperatives have received some support through the years from the U.S. Department of Agriculture and the Agricultural Cooperative Service in the form of regional workshops (USDA 1967; USDA 1965) and intermittent organizational support (Dempsey & Markeson 1969; Seymour 1983; Simon & Scoville 1982).

Forestry cooperatives numbers are few and membership is meager. No "exact" count is available (the last published survey was done in 1979). Recent estimates vary widely, ranging from 7 cooperatives comprising 1078 members nationwide (Simon & Scoville 1982) to 143 cooperatives (Knox 1969).

Cooperative success is spotty. Despite a wide variety of "cooperative" activity and organizations around the country, NIPF owners do not seem to have achieved nationwide success in developing and sustaining cooperatives. Some cooperatives have been in existence for a long time and if success is judged merely by longevity, they might be considered successful. For example, Forest Owners Inc. in Yazoo City, Mississippi, began in 1961 (Rice 1989) and the Forest Management & Sales Association in Olympia, Washington, began in 1965 (Shay 1988). These are notable exceptions, however.

Although Federal, state, and even some local subsidy, loan, and tax incentive programs exist to help finance individual owners' activities, there are no dedicated financial incentive or funding programs to assist forestry cooperatives. This poses a serious drawback because of the large, "lump-sum" costs experienced in forest production and the intermittent nature of income from most NIPF properties. Further, the existing financial assistance programs do not treat the full range of activities involved with NIPF management.

Research into the formation and operation of forestry cooperatives has been done at irregular intervals, primarily by the U.S. Forest Service and the Agricultural Cooperative Service. Little, if any, ongoing research is being done.

In summary, although the U.S. does have forestry cooperatives, there is no organized or even skeleton national forestry cooperative program. The few existing forestry cooperatives are essentially "on their own." By his own statement, former Farmers Home Administration Administrator, Howard Bertsch, expressed the reality - "But let us fact facts: foresters and the rest of us in USDA have failed in the encouragement and establishment of forestry cooperatives" (USDA 1967).

Organization

Drawing from the most recent comprehensive survey of U.S. forestry cooperatives (Simon and Scoville 1982) and a series of recent interviews with cooperative managers, two types of operating structures exist - the cooperative and the association. Operationally, cooperatives try to provide a wide range of services to members; associations typically provide only member education. The key difference, however, between the two seems to be in their methods of raising capital. Cooperatives raise capital primarily through borrowing or the sale of securities, while building reserves through retention of net savings. Associations, while having the authority to raise capital in various ways, generally require little capital and raise it through annual membership dues (Simon and Scoville 1982).

In 1979, only four of the seven cooperatives were actually organized as true cooperatives. The remaining three were associations. Since then, at least one association and three cooperatives have disappeared. Two more associations were unable to be located and are presumed defunct. The remaining cooperative is still operating successfully and was interviewed for this study. Additionally, four new associations have appeared. It is interesting to note that two of the four new associations began as cooperatives, failed, and reorganized as associations.

Membership Profile

In 1979, the cooperatives and associations averaged 154 members, ranging from a low of eighteen to a high of 340. Four of the seven had more than 100 members, however, when founded, none had more than fifty members. The greatest single percentage of members fell in the forty- to eighty-hectare (ha) class of ownership size. Collectively, about two-thirds of all members held between eight and forty ha. Only 2% held fewer than eight ha; and, nearly all organizations had some members holding more than 400 ha (Simon and Scoville 1982). The cooperatives and associations currently average 146 members each, ranging from 85 to 210.

Both cooperative and association members are primarily individual forest landowners. Private and public institutions, however, may join if they qualify as timber owners. Nearly half of all members were farmers or ranchers. About one-third of the members were professional or business people. On average, about sixty percent of all members held their woodlands primarily as sources of income. After that, the other two most important reasons for ownership were tax shelters (15%) and recreation (14%) (Simon and Scoville 1982).

Activities and Management

Forestry cooperatives assist members in a variety of ways, including production, processing, marketing, and information. Specific forestry services include timber stand improvement and planting, management and market information, management plans, timber appraisal, cruising and marking timber, harvesting, preparing bids and negotiating contracts, purchasing and processing timber, market development, and selling forestry supplies. Authority to manage members' woodlands is usually not specified in charters or bylaws, but negotiated in separate management agreements between the organization and individual members. As mentioned above, associations focus strictly on member educational and motivational activities.

In the 1979, fewer than half of the organizations employed professional or managerial staff regularly. Most had at least a full- or part-time forester hired directly or working under some fee schedule. According to the survey, "longstanding forestry cooperatives and those progressing well enough to generate increased member activity and support additional services have found it necessary to supplement the work of managers and foresters with an expanded staff" (Simon & Scoville 1982).

The staffing situation has deteriorated since then, however. Now only one association employs full-time staff (a director and a manager). Two others pay a part-time office worker and the remaining association has no staff. The cooperative employs a forester/manager on commission.

While daily affairs used to be handled by the foresters/managers, these responsibilities plus long-term planning and decisionmaking now lie primarily with the directors and officers. Participation of these groups varies considerably among the organizations. Most organizations have from one to six board meetings per year. Nearly all have one general membership meeting annually, but few report more than just the elected board members and officers attending.

Finance

Financing forestry cooperatives occurs in two steps, start-up and ongoing operations. According to the 1979 survey, "each cooperative utilized member capital as an initial source of funds. Member investment ranged from a total of $125 ... to $24,000. Two of the seven cooperatives received startup capital through the sale of preferred stock to regional agricultural cooperatives. Other sources of startup financing included grant assistance from Federal resources and State forestry agencies, and loan capital from the Economic Development Administration, the Banks for Cooperatives, and local commercial banks (Simon and Scoville 1982). The only cooperative interviewed in this study requires each member to purchase a minimum of one $20 stock certificate as a startup fee.

Ongoing capital is raised through fees for services used and annual membership dues. Methods of assessing service fees vary greatly, ranging from hours, worker-days, acres, and cords to a flat-fee basis. In 1979 only three of the seven organizations collected membership dues, averaging $150 annually. Currently, each of the associations charges an annual membership fee ranging from $20 to $50. The cooperative was the only organization actually performing services for members and it levies fees for those services.

JAPANESE FORESTRY COOPERATIVES

History

Japanese forestry cooperative history is characterized by a high degree of central Government control, as documented by the numerous national laws and "projects." Understanding today's forestry cooperatives requires a brief review of the major legislation and policies that have affected forestry and cooperatives.

Modern forestry cooperatives began with the Forest Law of 1907. Four types of cooperatives were authorized: afforestation, management, protection, and earthwork. While cooperatives were not mandated, if between two-thirds and three-quarters of a region's owners voted for establishment, the decision was binding on the remaining owners.

With the Forest Law of 1939, the Government established cooperatives as distributors of financial subsidies to farmers conducting forestry activities. The Law focused on developing private forest resources and through the Agricultural and Mountain Village Relief Project provided subsidies for forest roads, log rafting waterways, and charcoal warehouses. Cooperatives were made compulsory in all municipalities where private forests exceeded 500 ha or annual timber shipments exceeded 825 cubic meters (m^3). Further, Government supervision (i.e. drafting, implementing, and coordinating) of private forest management plans was delegated to cooperatives.

During the W.W.II years, beginning with the Timber Control Act of 1940, NIPF owners complied with compulsory harvesting based on cutting plans enforced through the cooperatives' organized labor groups. This established the cooperatives "in business" as wood producers and distributors (Tanaka 1981).

After the war, the Forest Law of 1951 issued new planning guidelines for private forests and designated cooperatives as the "executive organizations responsible for assisting the forest planning system." Further, the previous cooperative system was to continue "without dissolution to avoid confusion." Two kinds of cooperatives were allowed, producers' and forestry cooperatives. Producers' cooperatives focused only on the production of forest products from members' lands. Forestry cooperatives were allowed more latitude with both "prescribed" and "selective" activities delineated, including providing facilities, supplies, and equipment for members (Morita 1988).

Reconstruction in post-war Japan promoted rapid growth of heavy industry in the urban areas. This stimulated the demand for timber and led to revision of the log and lumber distribution system and the creation of log and lumber auction markets. At the same time, the Government was learning that the level of activity among forestry cooperatives was far less than hoped for under the Forest Law of 1951 (Tanaka 1981). All of this led to the Forest Cooperative Promotion Measures of 1957 in an attempt to stimulate the cooperatives' economic activity, especially in the areas of sales and purchasing. The net result placed individual cooperatives and their prefectural federations in control of log and lumber auction markets, allowing them to supplant sawmills as the primary purchasers of logs.

The Japanese economy continued accelerating into and through the mid-1960's to the point that domestic demand for timber exceeded supply. Timber prices rose so sharply that the Government instituted Emergency Measures to Stabilize Timber Prices, attempting to solve the problem by importing large quantities of logs. During the same period, significant population migration from rural to city areas caused labor shortages and wage increases. Between 1962 and 1967, forty percent of Japan's full-time loggers found other jobs. These events prompted several national legislative responses:

- Joint Forestry Work Promotion Project: 1962,
- Forestry Cooperatives Consolidation Promotion Law: 1963,
- Forestry Structure Improvement Projects: 1964, 1972, 1979, 1980, and
- Plan For Improvement of Regional Forestry: 1980 (Morita 1988).

In summary, Japan currently hosts nearly 1800 forestry cooperatives with almost 1.7 million members (Morita 1988). The cooperatives are regional centers for all private forestry activities. They are both vertically and horizontally integrated businesses operating locally, regionally, and in some cases nationally (Morita 1988). Often, the cooperative is the locality's dominant business entity. Cooperatives are supported by both strong and active prefectural (Prefectural Federation of Forest Owner's Associations) and national organizations (National Federation of Forest Owner's Associations). Forestry cooperatives receive financial and political support at all government levels from local to national. Finally, scholarly research into all aspects of cooperatives continues nationwide.

Organization

Although called both "cooperatives" and "associations," the Japanese forestry cooperatives are truly cooperatives. They are chartered by the National Federation of Forest Owner's Associations and operate under standard bylaws provided by that organization. Japanese cooperatives provide a much wider range of services and supplies than do their U.S. counterparts.

Member Profile

Most cooperative members are farmers living on or close to their forest land. Some members, of course, are not farmers and some live far from their forest land. Overall, however, these types of members are in the distinct minority.

Although the typical member has more than one source of income, most income is agriculturally derived. Commonly, a farmer will combine the production of agricultural crops and livestock with timber. Less common, but becoming more prevalent, is the NIPF owner who takes a second job, either full- or part-time, to supplement income from the forest land.

Although a few cooperative members own more than 500 ha, the majority (56%) of NIPF owners own one ha or less. Eighty eight percent own five ha or less (Matsushita 1988). It is not uncommon for cooperatives to have more than 1000 members and for the cooperative membership to include 98% of a locality's NIPF owners.

Activities and Management

At least on paper, Japanese and U.S. forest cooperatives conduct similar activities and provide members with similar services. Japanese cooperatives provide assistance with management planning; forest planting and all phases of subsequent management including harvesting, cruising and timber marking; timber appraisal; marketing including purchasing of forest products; and purchasing forestry equipment and supplies.

As done by only a few U.S. cooperatives, many Japanese cooperatives have their own products processing facilities and marketing organizations. Some have gone even further to operate secondary businesses that use cooperative-produced products as raw material inputs.

Most Japanese cooperatives have at least one full-time staff person. The majority have several staff, both full- and part-time including professional and non-professional. The manager is usually a seasoned cooperative employee who, by background and in U.S. terminology, is a degree-holding professional forester. Cooperative staff can be divided into management (manager and section chiefs) and non-management (usually clerical and laborers) categories.

While day-to-day affairs are guided by the management staff, policy and long-term decisionmaking is done by the board of directors. Most cooperatives have from nine to 20 directors who serve three-year terms, sometimes consecutively for many years. Their degree of participation and the general level of leadership activity varies considerably among cooperatives. Most of the cooperatives have at least six board meetings per year; some have more depending on need. All cooperatives have one general membership meeting annually.

Finance

Because Japanese forestry cooperatives have existed for so long, there is no need for "startup" capital. Ongoing operating capital comes from several sources including membership dues, service fees, sales income, loans from several sources, and Government financial subsidies. Most members pay an initial fee to join the cooperative (sometimes a flat fee and sometimes variable according to ownership size). Some cooperatives then assess additional annual membership dues. All cooperatives interviewed publish a schedule of charges for services provided.

All of the cooperatives interviewed maintained some kind of debt, either long- or short-term. Loans to cooperatives come primarily from two sources, both at the national level: 1) the Agriculture, Forestry, and Fisheries Finance Corporation, and 2) the Central Cooperative Bank for Forestry and Agriculture.

The most important source of cooperative financing is the Government program of financial subsidies. Cooperatives can prosper or die according to their leaders' abilities to direct resources toward activities that will garner subsidies. Review of the comprehensive subsidy system is beyond the scope of this paper, but some idea of the size and complexity of this massive system can be gained from the list below. Subsidies are not paid directly to individual owners, but are paid to cooperatives who act as distributors to the owners. Under many subsidy programs, cooperatives themselves are eligible for subsidies. Following are the major categories of subsidy programs available for forest owners and cooperatives, each category containing many separate financial subsidy programs:

- Planting and Thinning

- Road and Trail Construction
- Nematode Prevention
- Equipment Purchase
- Special Financial Subsidies from the Agriculture, Forestry, and Fisheries Finance Corporation
- Special Financial Subsidies from the Central Cooperative Bank for Forestry and Agriculture
- Forestry Improvement Fund
- Promotion of Domestic Timber Production
- Forest Planning System
- Protection Forest System
- Forest Insurance by Cooperatives
- Forest Insurance by the National Government (Mochida and Hori 1989).

CONCLUSIONS

Cooperatives composed of nonindustrial private forest (NIPF) owners exist throughout the world. They improve millions of owners' lives and increase forest production on millions of ha of the world's forest and farmland. The U.S. and Japan each host forestry cooperatives, but in much different styles and with much different levels of success.

Japan hosts nearly 1800 NIPF cooperatives with almost 1.7 million members. Cooperatives are important local and regional businesses supporting large staffs, often spawning other "spin-off" businesses. Cooperatives receive active support from all levels of government and they have their own prefectural and national management and support federations. NIPF owners see cooperatives as desirable mechanisms for improving their lives. Although cooperatives are continually adjusting to changing economic conditions, they are likely to continue as viable sociological, political, and economic entities.

There are few NIPF cooperatives in the U.S. Most that do exist have restricted their operation, functioning merely as educational "associations" rather than service-providing cooperatives. Member participation is often "guarded" so as to relinquish the minimum amount of individual autonomy and control. Government support, at any level, is almost totally absent. Log buyers and mill owners often openly oppose cooperative formation and operation. While real potential for the cooperative concept exists, realization will require major structural and economic changes in the forest management and products industries. Equally important, and perhaps even more fundamental, such changes must be accompanied by sociological and political changes by U.S. NIPF owners. Cooperatives will never really prosper until owners are willing to surrender some of their autonomy for the good of the whole.

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INTEGRATED USE OF EXTENSION SERVICE IN SWEDISH FORESTRY

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SUMMARY

In Sweden like other countries with privately-owned forests different forest political means are used integratedly to influence the forest owners. Evaluations, more or less scientifically performed, indicate that the effects of the means will increase if you base the use of them upon a forest inventory. In some field studies it has been an attempt to isolate the effect of extension service. There are many indications that a well planned extension service systematically carried out and based on inventories and management plans gives an obvious increase of the forestry operations.

It is also essential for the result that the authorities are successful in attaining a good balance between their fiscal work and their extension service.

INTEGRATED USE OF EXTENSION SERVICE IN SWEDISH FORESTRY

1. THE CONCEPT OF EXTENSION SERVICE

In countries with privately-owned forests, many different means are used to influence the forest owners for example forestry acts, extension services, loans, subsidies, taxation laws etc. Extension service is the lowest common denominator existing in all the member countries. I also believe that we can agree about the definition: Extension service is an instrument to transmit knowledge mainly from the research and development institutions as well as from experienced agents to private forest owners. In a wider sense, extension service includes transmission of policies from authorities and organizations to forest owners.

2. FOREST POLITICAL BACKGROUND

2.1 Short History

In Sweden, extension service has existed in an organized form since 1905, when the County Forestry Boards (CFBs) were founded. The National Commission, which in 1899 suggested the foundation of the CFBs, realized that a forestry act was not a sufficient instrument. The Commission found a need for a "living agency" to support and advise forest owners.

The Swedish Parliament decided to found the first modern forestry law as well as to establish "a living agency" in the form of county forestry boards.

Since the start, the idea of the activity of the boards has been to work integratedly with forest political means, such as the forestry act and extension service.

However, much has changed during the last 90 years. The forestry act has been made more stringent with the years and been extended concurrently with the increased importance of forestry for the Swedish economy, employment, environment, recreational life etc. The extension resources have increased and national subsidies to forestry have been introduced. Appendix 1 shows the most important changes in forest policy to date during the 20th century.

To all appearances the CFBs have succeeded in balancing their fiscal work as well as the extension service. New studies on the forest owners' attitudes towards the CFBs, the forestry act etc. show this fact.

2.2 Forest Political Questions of Today

Before I describe how the National Board of Forestry and the CFBs use the current forest political instruments, it might be of some interest to know about the forest political questions and problems in Swedish forestry and forest industry in 1990.

2.2.1 Wood Supply

The annual growth is almost 100 million m^3. It is possible to cut c. 75 million m^3, which corresponds the industrial demand for timber. The annual cut amounts to only c. 67 million m^3 (average for 1986-89).

The potential to increase timber harvesting exists on private land and there is a strong political pressure on private owners to do this.

2.2.2 Land Use and Nature Conservation

Since the beginning of 1970, there is a strong general opinion demanding that all forestry, also the state-owned, should pay attention to nature conservation, out-door life, tourism etc. in silvicultural and cutting operations. The opinion has not faded. On the contrary, new fields with conflicts of interest have come into focus, such as mountain areas, coastal regions, wetlands and areas with selected valuable deciduous tree species. Also abandoned agricultural land which could be afforested to some degree, belongs to this conflict of interests.

Air pollution and soil acidification are complicated problems causing great damage to the forest.

2.2.3 Employment and Development in rural Areas

Forestry is of the greatest importance for the employment. Mechanization and rationalization, choice of new methods and intensity influence the need for labour.

Extension service is an important mean to increase the employment in private forestry by stimulating forest owners to increase cuttings and silvicultural operations (planting, cleaning, thinning, pruning, fertilization etc.).

3. ORGANIZATION

The national forest administration, carrying out the forest policy, consists of the National Board of Forestry (130 persons) and 24 County Forestry Boards (appr. 2 500 persons).

The smallest units of a CFB are the districts, approximately 10 in each county and totally 250 in the country. The district staff consists of 2-5 technicians and 2-5 foremen.

4. SOME DATA ON PRIVATE FORESTRY

All forest owner categories in Sweden are subject to the forestry act. The CFBs have to supervise that the forestry act is followed on land belonging to the state and forest companies as well as private forest owners. The dominating target group for the work of the CFBs is the private forest owners. Some rough details about the privately-owned forests could be justified.

Private forest owners dispose 50 % of the Swedish forest area and 60 % of the production potential (they own the richest soils). The area is distributed on 240 000 holdings with 400 000 owners. The average holding amounts to 50 ha.

The private forest owners contribute with 55 % of the timber delivery to Sweden's forest industry which is of great importance to the country's economy. It is feasible to increase the importance of privately-owned forestry even more by enhancing the timber harvests further and by using greater intensity in silvicultural methods. Extension service is an important instrument to attain such a progress.

If we look at one of the 250 districts, we will find the following average figures.

Public forests	25 000 ha
Company forests	22 000 ha
Privately-owned forests	47 000 ha
Total	94 000 ha

The number of privately-owned holdings per district amounts to barely 1 000. Approximately 1/4 of these are combined with agriculture. Other holdings have none or a small amount of agricultural land.

5. INTEGRATED USE OF FOREST POLITICAL MEANS

5.1 Means in Forest Policies

The district staff at the CFBs has, as mentioned before, to give advise to the forest owners as well as to supervise that the forest is managed according to the forestry act. Furthermore, they distribute national subsidies. They also carry out contractual services to forest owners and authorities mostly in form of silviculture and nature conservation.

Since 1980, we have a new instrument, the general forest inventory (GFI), which informs us about the need for silviculture and timber harvesting on private land. (How GFI is used is treated in section 5.2.)

The activity can be summarized according to the following matrix:

Forest political means					
Goal	Inventory	Forestry Act	Extension Service	National Subsidies	Technical Service
Timber harvest					
Silviculture					
Nature conservation					

Within each goal area the mean or the variety of means are chosen best leading to the goal i.e. higher quality in nature conservation or larger areas treated with silviculture.

For the fiscal year 1990/91 the organization disposes the following national means.

Extension service and legal supervising	appr. 180 million SEK
General forest inventory	appr. 60 million SEK
National subsidies to silviculture, road construction etc.	appr. 240 million SEK

Activities are planned on various levels in form of work days. A means in the planning is the earlier described matrix, in which the number of days are filled in for inventories, extension service etc.

Regarding extension service which is the main topic at this meeting, I would like to mention the following.

From a questionnaire sent to the member countries of the Joint Committee (Enander 1980), it emerged that the outer forms of extension service were very much the same in the various countries. I had the same experience from a Joint Committee seminar in Canada in 1987. Therefore, nothing new is attributed to this meeting, if I report how we in Sweden perform forest days, forest evenings, machine demonstrations, short courses etc. for the forest owners or how we give them individual advice by visiting their holdings.

It can only be stated that these actions are well-proved forms how to communicate with the forest owners. Therefore, I intend to describe how GFI is used for planning the extension work and a special activity to increase the harvesting. I would like to concentrate myself on the evaluation of extension service and the conditions I consider to be essential to succeed in this field.

5.2 Use of GFI as a Basis for Extension Service etc.

It may seem obvious to base an extension programme on a thorough analysis of the need of silviculture of the forest owners' holdings and on their need of knowledge how to execute their work. (The minimum need for silviculture is stated in the forestry act. In the long run it may also be economic for the forest owner to do even more.) However, there have been difficulties in the districts to make analyses and plans with a staff consisting of only 2-5 persons and little access to inventory material. Often they have worked by instinct and not always reached those forest owners best needing advice.

Evaluations have shown that a rather great number of forest owners, maybe 20-25 %, never have been visited by a county ranger or participated in a forest day, course or similar.

Since 1980, there is an on-going general forest inventory, GFI, of all privately-owned forests. It will be ready in 1993 and cover c. 11.5 million ha forest. At the same time forest management plans of private holdings based on GFI are made. The plans can be made by anyone. They must, however, have a certain standard. In 1990, it is estimated that some 70 % of the forest owners will have up-to-date plans of their holdings. GFI and the forest management plans will drastically ameliorate the possibilities ot the CFBs to plan extension work. From the inventory material they can select the holdings in great need of improvements and get in contact with the owners. Owners with similar problems are offered consultations in groups (instruction, courses etc.). The county rangers can also offer individual extension service based on the forest management plans. This applies to detailed planning of silviculture and cutting, estimation of allowance to cover fixed costs, practical instruction etc. The individual extension service, ordered by the forest owner, costs c. 300 SEK/h (1990). The main part of the extension services is free of charge.

The great advantages of this described planning are

* Extension service is given to an objective selection of forest owners. The forest owners are ranked according to their need. On the list of forest owners being offered consultation, there may be absentee proprietors and forest owners difficult to reach, who the forest ranger otherwise easily could ignore.

In this way the forest advisors break into the lines of a forgotten group among the forest owners.

* The accuracy of extension service is increased by avoiding activities organized at random.

* Individually adjusted extension service is offered.

GFI is also used to identify stands which need treatment according to the forestry act as well as silvicultural measures which can be carried out with national subsidies.

GFI is available for everyone and is used by forest owners' associations, timber buyers, communities, environment organizations etc.

5.3 Evaluation of GFI

During the first six months of 1990, an evaluation of GFI will be made. The result will be given viva voce at the meeting.

An earlier evaluation (1985) of 160 000 ha spread all over the country shows that the activity in forestry is considerably higher in areas having been inventoried than the average of all forest land.

Example

Reforestation had increased by	38 %
Thinnings had increased by	124 %

These are the total results obtained through work carried out by all concerned parties. The result cannot be attributed to any special effort or forest political mean.

5.4 Project "Increased Timber Harvesting"

In chapter 2, I described the situation concerning the lack of raw material to the forest industry in Sweden. The industrial capacity is 5-10 million m^3 above the annual cut. This corresponds roughly to the feasible timber harvesting increase in private forestry.

Therefore, the government invested during the three-year-period, 1986-89, a total of appr. 30 million SEK for extension services to increase the cuttings. The campaign is conducted by the National Board of Forestry. The extension service is provided by the advisors of the CFBs. Analysis, planning and realization have been done in the following way:

The CFBs have, as mentioned before, inventoried a great deal of the privately-owned forests. From computor print-outs and maps the CFBs can select holdings with great potentials to cut. Guided by these, it is possible to produce an exension plan with great accuracy to reach those forest owners who ought to be influenced in the first place. It is also required by law that there must be a minimum volume harvested in a 10 year period.

As a rule, the extension service is organized by personal visits to forest owners. By means of the forest management plan, which usually exists, a harvesting plan is developed and a selection of stands to be clear-cut is chosen for the coming years.

The time the CFBs generally dispose of is one half day for each forest owner with a cost of 1 000 SEK per forest owner.

6. EVALUATION

In an evaluation it is often difficult to isolate the effects of extension service due to the fact that many means are used to influence the forest owners. Furthermore, many external factors may affect the forest owners' behaviour, such as taxes and fluctuations on the market. To date, the effects of extension service have been evaluated at a short range and been limited to special projects.

An example of this is the evaluation of the project "Increased Timber Harvesting" which shows the results from visits and individual extension service.

The project was evaluated in 1989 in an inquiry to the CFBs, three years after the start. The evaluation came to the following result:

* 30 000 forest owners received advice about cuttings
* The total cutting increase is judged to be 7-10 million m^3
* The extension service costs 4-5 SEK per cut m^3
* The forest owners' attitudes towards extension services were mainly positive
* The forest owners wanted more extension services, especially with regards to economy

Another example is the evaluation of an intensified extension service to forest owners within an inventoried area (GFI c. 20 000 ha). All forest owners had visits from a forest ranger. Jointly silvicultural and cutting operations were planned and it was estimated how much similar operations had been carried out previously per year. After three years the changes on the holdings were evaluated and the following was noted:

- Each consultation day had increased the cuttings by about 200 m^3/year.

- Planting and cleaning had increased.
- Each consultation day had increased the employment, especially due to the higher level of the annual cut, by c. 30 days (cost appr. 13 000 SEK per annual work).

6.1 "Total Evaluation"

The broadest and deepest evaluation of the forest policy is made by Professor Per Stjernquist, University of Lund (Stjernquist 1972). It is a study of the public direction of the private forestry during 1905-1960. Stjernquist examined carefully the legislative and extension work carried out by the CFBs. Some of his main conclusions were:

"There is thus no reason to give up the conclusion that during the greater part of the period the activity of legal authorities was the basic reason for the behavioral changes in private forestry.

This does not mean that the part played by the laws is not open to doubt. The legal influence process has its formal point of departure in the laws but it may contain activities with extremely varied and sometimes almost non-existent connections with the law. The investigation shows this very clearly. In some cases, the field personnel in their work of influencing used the norms and sanctions of the law as pressures. In the majority of cases, however, the personnel avoided invoking the law: they worked with give-and-take methods and mutual understanding; they used the law simply as a vague internal framework in formulating appeals to forest owners. "The last sentence expresses what we can call extension service.

The following inquiry gives an interesting view on tha above mentioned study.

The Swedish University of Agricultural Sciences has in an questionnaire tried to map out the forest owners' knowledge and opinions of the forest economy, the forestry act, the CFBs etc (Löfgren and Hansing 1989).

Barely 3 000 forest owners received the questionnaire. 44 \ answered. The answers, however, indicate their attitudes. A few results (round figures):

70 \ knew the fundamental features of the forestry act.
Only 6 \ of these found the act unnecessary.
41 \ had more faith in the extensions service from the CFBs.
21 \ had more faith in the extension service from the forest owners' assocations.
2 \ had more faith in the extension service from the forest companies.

My interpretation is, that the forest owners in general accept the pursued forest policy and have confidence in CFBs. At the same time I want to mention that in the current discussion some political and ideological objections are raised against the pursued policy.

7. TO CREATE PREREQUISITES FOR A SUCCESSFUL EXTENSION SERVICE

On the whole the same pedagogical principles should be used for forest extension services as for adult education. Therefore, I will not enter into these subjects but only point out some factors which I think are especially important to achieve good results in the extension work. These are the following factors:

* Organization
* Relationship between extension agents and forest owners
* Qualification of extension agents

A strongly decentralized organization with a regional and local organization has proved to be most successful for the CFBs. The ranger is placed as it were in the middle of the village. Gradually he gets to know the forest owners and the condition of their forests. Many rangers have been offered employment in their home district. These circumstances are favourable for the relationship between the forest owners and the rangers. Good relations are a prerequisite for extension service work to be successful. The rangers are not only extension agents, they also supervise the observance of the forestry act, carry out services such as forest management planning, marking and are in charge of relief work teams. The variety of the working tasks have proved to be positive for the relations.

The forest owners have confidence only in extension agents who are qualified and unbiased. They have to trust the advice they get.

Therefore, it is essential that the extension agents are integrated in a "system" to obtain the knowledge which gradually supplies them with new results from research and practical experience. The "system" includes an annual further training in forestry subjects. Their educational and methodological qualifications are kept up and they obtain current summaries of research results etc. A programme on how the CFBs can improve the acquisition and the distribution of new research results is developed.

In cooperation with the research institutes we have adjusted the design of information to suit the forest technicians and forest officers.

The idea with extension service is to transmit knowledge and the success in doing so is completely depending on how you succeed in linking up research and extension service to one system functioning in the practical daily work.

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Appendix 1

SWEDISH FOREST POLICY DURING THE 20TH CENTURY

1903 the first forestry act. It prescribed obligations to regenerate after final felling.

1905 the County Forestry Boards were established.

1921 a new regulation prescribing obligations not to clearcut young forests.

1941 the National Board of Forestry began its activities.

1948 a new, extended forestry act was accepted. The act contained regulations on regeneration, thinning and final felling.

1974 a new act was established for the protection of beech forests which no longer could be felled without permission.

1975 a section on nature conservation was introduced in the forestry act.

1979 the Swedish Parliament established guidelines for forest policies. The aim was to provide a permanently high and valuable timber yield and to considerate nature conservation and other public interests.

The Parliament introduced a section on cleaning of young forests. The Parliament decided all privately-owned forests to be inventoried.

During the 1980s the following amendments were introduced:

Obligation to thin in dense stands.

Obligation for all forest owners to have a forestry management plan.

Obligation to harvest a minimum timber volume during a ten-year-period (applies to only 10 % of all holdings).

TECHNOLOGY TRANSFER AND EXTENSION IN NEW BRUNSWICK, CANADA

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SUMMARY

A review after a decade of technology transfer aimed at woodlot owners in New Brunswick, Canada, indicates that special skills and organization support are required to optimize technology transfer success. Five key points are identified as potential evaluation questions for specific projects.

Keywords: specialist skills, organization support, indicators

INTRODUCTION

In New Brunswick about one quarter of the Province's industrial wood supply is derived from private woodlots, but only a small percentage of woodlots produce wood on a sustainable basis. From a survey in the early 1980's it is apparent that many woodlot owners hold the land for reasons other than producing fibre, but would consider undertaking forest management and some harvesting if appropriate technology and environmentally soft systems were available. As there is currently no legislation forcing forest management on private woodlots, and most land owners are not financially dependent on harvest from the woodlot, any activity on these woodlots is undertaken on a voluntary basis.

Technology Transfer was introduced nearly a decade ago under a Federal Provincial forestry development agreement. Its purpose was to enhance the viability of woodlots through providing tools and methods for harvest, forest management, Christmas tree and maple syrup production. Its objective, as defined in the current agreement, is

" - to provide owners with the forestry and business information and training necessary to increase the income and employment generating potential of their woodlots, and
- to encourage the development, application and dissemination of cost-effective technology appropriate to the woodlot sector."

Thus, technology transfer in the woodlot sector can be viewed as an adult education program which combines awareness of forestry practices with development and demonstration of appropriate machinery and the specific operating systems requires for that low powered equipment to perform to acceptable standards.

To provide a better fit between user group and equipment an arbitrary stratification system was developed. On the low productivity end lies the technology suitable for the hobby operator. It is suitable for the week-end harvester producing in the neighbourhood of 15 to 20, possibly up to 50 cubic meters annually. It must be relatively low in cost. Much of this type of equipment may have a secondary, often recreation oriented use. The mid-range type of equipment would fit the pocket book and productivity of the part-time harvester, a land owner who might operate two or three months a year in the woodlot to derive income from this work. Annual production of 200 to 600 cubic meters might be expected from this type of operation. On the upper end of the scale would be equipment aimed at the full time operator/contractor who would require environmentally soft yet efficient equipment and who could afford the higher price associated with it.

Most of the effort has been directed at bringing into Canada and demonstrating equipment from the Scandinavian countries, though some items for the hobby operators have been developed locally. The primary thrust has been at the introduction of new ideas or concepts rather than a specific model of machine. The past decade has shown that a skill level beyond that usually expected from Extension personnel is required for technology transfer, and that the organization support can enhance or defeat a technology transfer program. Five questions have been developed to test and evaluate potential success of individual technology transfer projects, though the answers must be evaluated in light of the individual project versus a wider range of potential users. In retrospect then, a look at some factors which could enhance the success ratio of a technology transfer program based on a decade of observations.

EXTENSION SPECIALIST SKILLS

Expert forestry knowledge and good communication skills are prerequisite to extension work. Technology transfer requires the additional skill of system analysis and the capability to break with the traditional and learn new ways - and then showing the client how and why this new way is better than the old practices. Only rarely is the new technology so obviously superior that it will sell itself.

Potential solutions to problems come from various sources, possibly from the Research and Development program of a local university, possibly from practices developed over decades in a country half way around the world. The specialist must search out the applicable solution, then introduce and test it locally. If rejected, the project fades into oblivion, though some components may find alternate use. Through this process of testing the specialist supplies the necessary support and encouragement to his client. He must work alongside him, be available when problems develop, and find solutions. Often new machinery suitable for woodlot work requires very specific operating practices, departures from the traditional that the client finds hard to accept. Operators familiar with the size and power of industrial equipment look for similar production from the smaller machines, the capability to ride on it rather than walk in front or behind.

To complete the technology transfer cycle, the specialist must promote successful projects. Word-of-mouth advertising, local field day demonstrations, even mass media exposure are part of the tools he must be familiar with. Where specialist education staff is available to carry out the production of the promotion material it is the technical specialist's role to check the factuality of the material produced, be it a hand-out brochure or a audio-visual training package. Though he himself may not need to be an accomplished actor or gifted writer/photographer, the technology transfer specialist should take the lead role in selecting the most effective dissemination system and be on hand to ensure that the key features are highlighted, potential problem areas identified and solutions to them provided.

ORGANIZATION SUPPORT

The majority of extension efforts are funded by governments or educational institutions. Agriculture extension and associated technology transfer has received recognition for value through local government efforts and the effectiveness of such international organizations as the F.A.O. and their work to better the world food situation. Technology transfer in forestry, especially as it relates to private woodlots in North America; has still a long way to go to achieve a similar level of recognition and support.

To provide a suitable environment for technology transfer the supporting agency should commit itself in five major areas. It should provide time and means to gather information on a world-wide basis, to provide research and development capacity including training and support staff, to provide adequate budgets for equipment purchases and modifications, allow for work time flexibility for its trained staff of specialists, and provide the means to produce and disseminate the required support materials.

Information Gathering

Access to computerized world research and development data banks is used extensively by the academic world to aid technology transfer. Unfortunately general availability is still very limited. This information does not replace the need for face to face information exchange and personal contact as can be derived from attending meetings, exhibitions and field days. Often an on-site inspection will give a better feel concerning a project's transfer potential than lectures, books and movies combined. Travel budgets must be available if a technology transfer specialist is to be effective.

Training

Applied research and development technology must be mastered before it can be passed on successfully. Extension staff familiarization and hands-on training is a key to getting internal staff evaluation (and adoption), prior to them offering it to their local clientele if the technology is suitable. Training sessions of this nature required suitable sites and skilled labour support, and sufficient training time for the technology transfer person to become proficient in the use of the technology.

Equipment Budget

Woodlot technology often must be adapted from recreation or farm equipment. The necessary funding for purchase, modificiation or re-design to meet safety and performance criteria must be available to prove or disprove the tool's usefulness to the woodlot operator. In-house capability to carry out engineering and metal fabrication would be an asset.

Worktime Flexibility

Woodlot extension, technology transfer and the 8 to 5 legislated work day are incompatible, at least in New Brunswick. The majority of land owners work in other occupations. They use their woodlot tools in the evening, on week-ends and holidays. If something goes wrong, they want help - NOW. Group education, the class room sessions as well as the field days and woodlot demonstrations follow the same pattern; evenings and week-ends. The technology transfer specialist must have the flexibility to adjust his work time to client demand and take his personal time at his own discretion.

Promotion Support

As stated in the introduction, technology transfer in relation to extension forestry is a form of adult education. Once a tool or method is proven locally in a one on one situation, the message must be spread to interest other potential users. The mass media can be used to introduce the concept, but more in depth treatment is needed to sell it. To get the promotion needed, the message must be packaged. This may be in the form of an instructional video tape, a prepared teaching module for evening courses, or it may be a descriptive pamphlet for hand-out at a local fair. Ideally the packaging is done in-house by professional communicators working together with the technical experts to provide accurate information within a reasonable time frame to acceptable communications standards. Once packaged to these standards, it is possible to market the product and complete the cycle of technology transfer.

FIVE QUESTIONS TO TEST PROPOSALS

In retrospect, a positive response to all five of the following questions would have virtually guaranteed a successful technology transfer project. One negative or two half-hearted "maybe's" would leave the project a fighting chance for success. Two or more negative evaluations indicate a very high probability of failure for the project. The test pre-supposes a high level of experience and skill of the evaluator, and evaluation on the micro-level, at the one-on-one stage, may well change when applied to broad scale adoption. The five questions are:

Is It Affordable

A somewhat relative question, it non-the-less has proven over time to be the most influential question in the adoption/rejection process. Affordability at the micro stage of evaluation may well be influenced by such factors as alternate uses for the technology away from the forest work environment, for instance the applicant's willingness to pay a higher price because the technology also serves a recreation oriented goal.

Is It Appropriate

The appropriateness of a new technology may be judged from two aspects: can it do the job within the technological standards set, i.e. "... haul out three cubic meters of wood per hour over trails not exceeding three meters wide without leaving ruts," or judged by the economic parameter valuation, i.e. "... given the speed and load capacity, can this technology provide sufficient income required by the operator/purchaser?"

Is It Available

One of the key aspects in technology transfer is the ready availability of all the components to make the system work, including maintenance and repair needs and the skills to operate the system. Enthusiasm cools fast if during the trial period a unit does not remain operative and can not readily be fixed.

Is It Effective

To replace a traditional way of doing things, the new technology must have some feature that makes it attractive to the potential user. This could be a multi-purpose use, doing a better job with less effort, or doing a job faster and more safely. No matter which, in order to replace a traditional system with a new technology, the new way must be perceived to be more effective if it is to be adopted.

Is It Safe

Long overlooked in the practice of forestry technology transfer, especially in small scale forestry, this question is rapidly pushing its way into the foreground. Worker safety legislation and equipment safety standards prohibit introduction of potentially hazardous systems into the woodlot contractor labour force. Unfortunately, little constraint is placed on the do-it-yourself operator to maintain a system at least at a minimum safety level. Technology transfer projects aimed at the woodlot owner/operator should assure that the system is as safe as possible to better the deplorable accident record associated with small scale forestry operations.

CONCLUSION

As more and more land is alienated from forestry production it becomes increasingly important to motivate the private land owner to practice active forest management on a sustained basis. Research and development aimed at small scale technology and environmentally soft forestry practices will provide an important contribution toward reaching this goal. Matching the new technology and improved operating systems to the needs and desires of the individual land owner and land owner groups will require an increasing number of forestry trained individuals who can act as intermediaries between the research laboratory or the forest experiment station and the family woodlot. Technology transfer as part of extension forestry will serve to motivate more private woodlot owners to become part-time forest managers and provide them the tools and methods suited to their scale of operation. The need for small scale forestry equipment development and suitable operating methods seems to be universal. The challenge is there to every forestry professional to do a little technology transfer whenever possible, to help the woodlot owner help himself on his woodlot here in North America - or on the communal woodlot of some third world country.

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SUMMARY

Among the directions that a science moves as it matures is toward breadth of answers, depth of questions that can be answered, and cogency of the ideas. Cogency of ideas simply means that the constructs of a science are clearly stated by scientists in the discipline and are organized to the maximum extent possible. Constructs and important properties of concern are: concepts, in particular the predicate structure (order and degree) and their reference class; propositions, in particular the character of the concepts contained in the proposition and the proposition range; theories, in particular the propositions from which they are made, and the deductions that follow from each combination of propositions. Not all beginning sciences such as forestry have a large number of theories of their own. Some are only now beginning to emerge. Cogent forest research is research wherein the concepts, propositions, and available theories are clearly stated and used to their maximum in reasoning about the nature of the real world.

Keywords: mature science, research quality

INTRODUCTION

Mario Bunge (1968) says that mature sciences have depth, breadth, and cogency. Elsewhere I have argued that sciences answering difficult, "Why?", questions have greater depth than sciences answering "What is the character of?" questions (Leary 1988). Likewise, sciences that produce very general answers, i.e., universal or bounded universal statements, have greater breadth than those producing answers expressed as singular statements. But where does cogency fit in?

COGENCY

Cogency is defined as: "... 2 a: appealing forcibly to the mind or reason: convincing ... b: presented in a way that brings out pertinent and fundamental points ... .".Webster's New Collegiate Dictionary 1979.

While much of scientific research is action filled—measuring, calculating, weighing, mixing, etc., developing cogency in a scientific discipline is a distinctly cognitive activity. As such, it may lack appeal to action oriented forest researchers.

What are the components of cogency? Mario Bunge (1968) suggests the following interpretations for "cogency": "Better organized" (pg 121, line 2), "... organized axiomatically." (pg 121, line 23), and "Logical tightness", (pg 144, line 6).

What is it that is better organized? Briefly stated it is the ideas, i.e., constructs, of the discipline. The qualitatively different kinds of constructs are: concepts, propositions, and theories. How each is made cogent differs, so I treat them separately.

CONCEPT

A scientific concept is the fundamental unit of thought, it is not a complete thought as would be expressed in a whole sentence. Concepts can be analyzed from a number of perspectives. For example, we can ask the question, What does a concept do? Bunge (1974) suggests it maps objects into statement about objects. A scientific concept bridges the gulf between the world of objects and the world of language. Bunge suggests the representation be that of a mathematical operator. For example,

$$P: \{X\} \times \{Y\} \longrightarrow a,$$

where P designates a concept, e.g., "predation",
X and Y designate sets of objects,
× designates the Cartesian product of sets,
⟶ denotes a mathematical mapping, and
a designates the word 'predation'.

We may also ask, simply, what kinds of concepts are there? Listed below is a taxonomy of concept kinds (Leary 1985, page 13-14):

name of kind	examples
individual	"General Sherman sequoia"; "x"
class	"hardwood"; "softwood"
relation	"is taller than"; "outgrows"
quantitative	"basal area"; "total height"

A definite individual concept is usually designated by an individual's name; an indefinite individual concept with a lower case letter from the end of the alphabet. Class concepts apply to groups of individuals, where membership in the class is dependent on objects having certain properties. Relation concepts deal with relations among objects of some kind, and quantitative concepts function to map elements in the concept domain into the range (typically the set of real numbers).

The logical structure of a concept makes use of what is known about its predicate structure (Bunge 1974). Concept degree refers to the number of objects or sets of objects the concept maps from the world of objects to the world of language. For example, "hardwood" is a class concept of degree 1: Hx or H(x) symbolizes that object x has the qualities needed to earn membership in H. Likewise, predicates of degree two relate two individual objects and are symbolized: xHy, where H is the degree-two concept.

Concept order refers to the nature of the set objects the concept relates. For example, the degree-two concept "predation" relates wolf and moose, and can be symbolized: wPm, where "w" designates wolf, "m" designates moose, and "P" designates predation. Because the objects wolf and moose are things, this use of the concept "predation" is second degree (2 objects are involved), and first order (the relation is between real objects). If, however, the concept is the relation concept "interaction", designated I, the "objects" could be "predation" and "competition", as in pIc. Here, "interaction", I, designates a second order relation concept because the objects it relates are two first order concepts. Concepts of higher order are more abstract. An example of increased abstraction dealing with concepts to represent space occupancy by trees is shown in Figure 1 (after Leary 1985).

Finally, concepts may have different metrical characters: qualitative (good site, low site, better site) or quantitative (ordinal scale, site class I, II, III or ratio scale, site index 65).

When asked, scientists should be able to state the the important concepts in their scientific discipline or subdiscipline, and also know their kind, predicate degree and order structure, and metrical character. Quantitative concepts having higher degree and order predicate sturctures offer important advantages in the economy of expressing factual propositions, hence are found in advanced sciences.

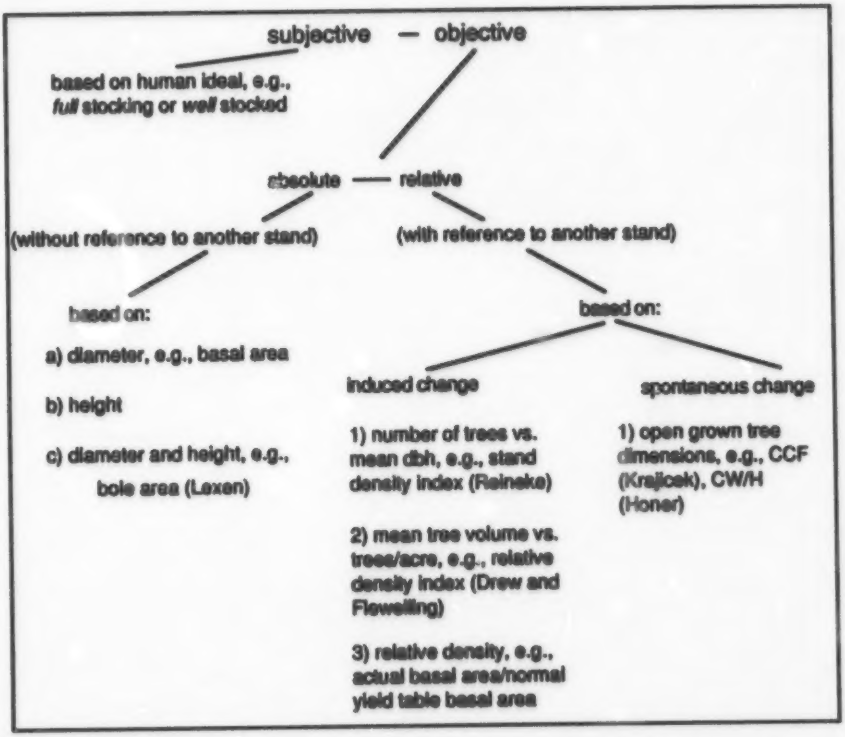
subjective — objective
based on human ideal, e.g., *full* stocking or *well* stocked
absolute — relative
(without reference to another stand)
(with reference to another stand)
based on:
a) diameter, e.g., basal area
b) height
c) diameter and height, e.g., bole area (Lexen)
based on:
induced change
spontaneous change
1) number of trees vs. mean dbh, e.g., stand density index (Reineke)
2) mean tree volume vs. trees/acre, e.g., relative density index (Drew and Flewelling)
3) relative density, e.g., actual basal area/normal yield table basal area
1) open grown tree dimensions, e.g., CCF (Krajicek), CW/H (Honer)

Figure 1: Concepts useful for representing the space occupied by a stand of trees (Leary 1985). Induced change is Bunge's term for change resulting from, in this case tree-tree, interaction. Spontaneous change is his term for change in the absence of tree-tree interaction (see Bunge 1974).

PROPOSITION

It is agreed among philosophers that a proposition is not just a declarative sentence. It is the sentence and its meaning. Propositions may be analyzed following principles laid out for concepts. However, propositions have the additional trait not held by concepts—they may be true or false. (Concepts are neither true nor false—they are just useful or not useful.) Determining the truth or falsity of a proposition is not germane to cogency analyses, so I do not discuss it here.

A proposition consists of factual and formal concepts. Formal concepts are such notions as "greater than", "belongs to the set", and so on. They are not about a property of a real object.

Propositions may be subject to internal evaluation by looking at:
a) the number of factual concepts they contain,
b) the predicate degree of each concept,
c) the predicate order of each concept, and
d the metrical character of each concept.

They may also be evaluated externally according to their range. Proposition range refers to what/when/where the statement applies. Examples developed from Bunge are as follows:

1) singular: "That tree is a hardwood."
2) indefinite existential (specify neither time nor place): "There are lots of hardwoods ."
3) localizing existential (specify time or place or both): "There are lots of hardwoods in Buchanan County."
4) statistical (states correlations, trends, modes, averages, scatters and other global (collective) properties): "Hardwoods tend to occupy the best sites in northern forests. "
5) bounded universal (states general fact with limited qualification): "Hardwoods succeed conifers on the highest sites."
6) unbounded universal (are law-like statements/they apply in all instances of a certain type, in all places, at all times):"Hardwoods succeed conifers."

Sample propositions from forest entomology, forest pathology, and silviculture are:

> "...the greater the diversification of tree species the less frequent will be insect outbreaks" (Graham 1963).
>
> "...there is no evidence that the virulence of the [chestnut] blight fungus has decreased" (Hepting 1974).
>
> "...tree class 1 achieved a higher increment in relation to basal area than the rest of the stand" (Assmann 1970).

Each proposition contains formal and factual concepts with differing predicate structures. Further, each proposition has a potentially different range. I leave the identification and classification of the concepts as an exercise.

Scientists should be alert to the differences in propositions that are possible scientific hypotheses, and purposefully develop ones that may be simply stated. As noted above, concepts with higher order and degree predicate structure can be immensely helpful in the simplifying process. Further, propositions alone are not the subject of experimental tests—it is the logical union of proposition, auxiliary assumptions, and initial conditions which are tested. Testability of the resulting union is enhanced if it takes only a minimum number of "variables" to state the proposition.

THEORY

Like many other words in science 'theory' has at least two meanings. One deals with an idea and is often used in expressions of the form " I have a theory on that... ." The term 'hypothesis' is more appropriate in such instances.

When one has several propositions about the workings of a thing or system, one may have a theory of how that that thing or system operates. However, one might not. Bunge (1974) calls a group of propositions a context, and represents it as follows:

$$C = \langle S,P,D \rangle,$$

where

S designates a set of proposition,
P designates a set of concepts contained in the propositions, and
D designates the domain of the context.

A context and a theory are different because every proposition in a theory is either a premise or a deduction. That is, the propositions are related by entailment. Theory is thus represented as follows:

$$C = \langle S,P,D,\vdash \rangle$$

where S, P, and D are as above, and $\vdash$ denotes logical entailment.

The place of theories in science is to represent more complex systems or processes than can be adequately represented with a single proposition.

Theories consist of four categories of statements: assumptions, initial conditions, premises and consequences. Every scientific idea requires the scientist to make some assumptions about how nature works. Assumptions are not bad, everyone makes them, but they should not be hidden. Initial conditions are what start the process of deduction. Premises consist only of definitions and axioms. Definitions are nearly always required to clarify the meaning of certain ideas, or at least prevent misinterpretation. They should be given early on when stating a theory. Following definitions, it is appropriate to state the axioms of the theory. Axioms are those propositions which are believed to be true about reality—they give the factual science content to the knowledge claims contained in the theory. Axioms should have a reasonably large domain of "truth". If they have very wide range, they may warrant law-like designation.

The second category of statements in theories are consequences, which consist of theorems and corollaries. Theorems state the result from using two or more axioms, and as many definitions as needed, to anticipate the workings of nature. A theorem is a statement of what nature should be like if the axioms are treated jointly and are true. A corollary is a sub-idea of a theorem and asserts a variant of the main consequent asserted by the theorem.

ADVANTAGES OF COGENCY

There are several advantages to cogency in scientific ideas. First, a cogently expressed proposition or theory is more easily learned than a non-cogent one. How much of our intellectual heritage are we effectively and efficiently handing down to students of forestry? There has been a very rapid growth in knowledge over the past several decades, yet most universities still only require a 4 year program of study. Lewis (1980, 1982) has made this point in his research to axiomatize 500 important theories of biology. Second, cogency may bring about more rapid growth of knowledge. By doing concept analyses scientists may understand why one "variable" does a better job of prediction than another. Perhaps it is because it has higher degree and order structure. Cogent scientific ideas are an excellent source of research projects because most dimensions of the knowledge claim, as well as auxiliary assumptions, and initial conditions, are clearly spelled out and are therefore candidates for further test. Third, when anomalies arise in the use of a proposition or theory, as they always do, scientists will have a better sense of what needs to be "fixed" if either has been cogently expressed.

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SIMPLICITY IN FOREST MODELS

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FDC: 0--01

SUMMARY

Four definitions of model simplicity are presented and evaluated on ease of use, applicability, and reliance on observations. Three of the four definitions are based on observations as applied to models, rather than on the models themselves. The definition that does not depend on observations to establish simplicity is chosen as the most useful.

Keywords: Simplicity, models

INTRODUCTION

According to Egon Spengler,[1] ". . . it's just that in science we always look for the simplest explanation." But what is "simplest", and can we use it once we've got it?

The intent of this paper is to present some alternative definitions of simplicity in models, describe the characteristics of each alternative, and to point out which definition I believe is the most useful in forestry models. The alternative definitions presented here are by no means inclusive. Many other definitions of simplicity have been and can be proposed. I have included those definitions I have heard expressed or felt were being used, even if they were not expressed, and which I consider to have some chance of successful application.

I have based many of the opinions expressed here on the works of Karl Popper, The Logic of Scientific Discovery in particular, an excellent paper by G. R. Dolby in "Biometrics", The Semantic Conception of Theories and Scientific Realism by Frederick Suppe, and The Structure of Scientific Revolutions by T. S. Kuhn. A bibliography of these references appears at the end of this paper, but I have not ascribed particular ideas to particular sources.

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[1] "Ghostbusters II", Columbia Pictures Industries, Inc.,1989.

DEFINITIONS OF SIMPLICITY

Simplicity as Least Degree

In this definition the model with the lowest mathematical degree is the simplest. As an example consider the simplest curve through a set of X, Y observations. The simplest curve is that curve with the least departure from linearity or the curve with the lowest degree that explains these observations. In this definition the model of a straight line, $Y = aX$, is simpler than the model of a quadratic, $Y = aX^2$, which is simpler than a cubic, $Y = aX^3$.

This definition is founded on the principle that generalizations can be achieved by induction from observations. Some group of observations are made as the result of experiment or measurement. These observations are examined for possible explanations for their behavior, and, on the basis of this examination, an explanation, a model, is developed. The simpler, as defined above, this model is, the better it is taken to be.

There are three particular problems with this definition. First, there is no advantage in this definition of simplicity. One model is chosen over another because the first is simpler, but there it ends. No further use can be made of the simplicity. In the example above, all models (equations) are of the form $Y = aX^b$. Having a power, b, equal one serves only to save ink or paper. It is not easier to arrive at the hypothesized model, nor to justify that arrival.

Second, defining simplicity in this way is easy for models with few variables, parameters, or equations, but determining which of two distance-dependent, individual tree growth models is simpler by these lights is very difficult or plain impossible. Would "simplest" be determined by comparing equations term by term and equation by equation, possible only when both models have terms and equations that can be matched? If the models were comparable to this extent, they would be so similar that "simplest" would have no meaning. Perhaps counting the number of equations in each model would establish "simplest". But rearrangement is always possible. An alternative for regression based models could be that the simplest model is the one with the fewest minimized linear sums of squares. This would be easy to determine but ignores the variables and parameters that go into each model, and would make all single equation models equally simple regardless of the number of variables or parameters. Thus, for models with many variables, parameters, and equations we have a double whammy; simplicity is difficult to determine and provides no advantage once it is determined.

The third problem with this definition of simplicity is that it is based on the observations used to develop the model, not on the model itself. The model is arrived at by induction from particular observations, by "fitting" (not necessarily regression fitting) the model to the observations. The simplest model has the least degree or the fewest moving parts for this set of data. However, a set of new observations of the same phenomenon may call for another model that is judged to be simplest. This model is not necessarily the same as the previous model, even though the observations are of the same phenomenenon. We then have two "simplest" models, one for each of the sets of observations of the same phenomenon. If we take the simplest of these two models as appropriate for both sets of observations, then at least one of the models was not simplest after all.

Simplicity as Fewest Parameters

A second definition of simplicity is that model with the fewest terms and/or parameters. For example, the model $Y = aX^b$ is simpler than $Y = aX^b + cY^d$ which in turn is simpler than $Y = aX^b + cY^d + eZ^f$. This definition is very much like the first definition and possibly could be included in it. I have separated it here since I have seen both definitions used explicitly and because there is a subtle difference between them. This difference is exemplified by the model $Y = aX^b$. In the first definition the value of b was a cause for differing simplicity. A value of one for b gave a model simpler than a value of two, which in turn gave a model simpler than a value of three, and so on. In this second definition of simplicity the presence of the parameter is the distinguishing characteristic; the actual value of b has no bearing on the degree of simplicity.

This is a more easily applied definition than the first one, particularly for the typical models used in forestry, since the estimated value of a parameter is not important. The model $Y = aX^{1.9}$ generally would not be considered to be simpler than $Y = aX^{2.1}$. The distinction between models with and without additional parameters is much easier to make. Also, in a regression based model inclusion of additional variables or parameters would change the value of parameters previously in the model, thereby invalidating any consideration of the value of any parameter as a criterion for simplicity.

However, this definition has the same problems as the first definition. No advantage beyond a savings in calculation time and printing space is bestowed by applying the definition. The one parameter model may be "simpler" than the two parameter model, but what of it?

This definition is also difficult to apply to models with many terms, but it is at least easier to apply than the first definition. We can count the number of parameters in the competing models and judge as simplest the one with the fewest parameters. Unfortunately, this implicitly assumes that the models are hierarchical; each more complex model contains the next simplest model as a subset, as $Y = aX^b + cY^d$ contains $Y = aX^b$. Otherwise the definition will lead nowhere. For example, if two growth models both contain terms for age, site and density but one model takes density as number of trees per unit area , while the other takes density as basal area per unit area, both models have the same level of simplicity and yet are very different. We cannot use the definition of simplicity to separate and choose between these two models.

Finally, this definition, like the first definition is based on the observations used to develop the model, not on the model itself. The definition pertains to the model with the fewest parameters that can be constructed to explain a particular set of observations. New observations on the same phenomenon will most probably result in a different "simplest" model that may have little in common with the previous "simplest" model. With this definition we arrive at the same contradiction we previously encountered.

Simplicity as Most Probable

A third definition of simplicity takes as simplest the model that is most probable or has the greatest likelihood of being a correct generalization of the observations. This probabalistic definition of simplicity is very often employed in model construction, although not as a measure of simplicity, through selection of models that have the greatest likelihood, as in maximum likelihood estimators. However, I do not mean to use the statistical principle of maximum likelihood as the definition of simplicity. The premise of model selection on this basis is that unless the description represented by the model is correct it is improbable or not very likely that the model would fit the observations so well, and that any other contending models have less likelihood.

As a definition of simplicity, rather than only a model selection technique, this avoids the problems of determining which model has the lowest degree of the parameters or which has the fewest number of parameters. It is also more objective in that it can be easily applied and agreed to by all who are dealing with the models. Often the very process used to estimate parameter values and select models carries within it the greatest likelihood tenet.

But this definition still depends on the observations used to develop the model, perhaps even more so than the first two definitions since comparison with observations (determining greatest likelihood) is the sole criterion of simplicity. Any change in the observations or use of a new set of observations changes the model chosen as simplest.

This difficulty is common to all three of the above definitions; simplicity in a model cannot stand alone but only as an adjunct to changeable observations. As is probably clear by now, I do not believe that any definition of simplicity that depends on the particular observations used to define a model is useful. Simplicity in a model must be a property of the model irrespective of the observations that may be brought to bear upon or within that model. Simplicity must be part and parcel of the model even if it is not possible to collect observations to support or refute the model.

Simplicity as Easiest to Disprove

The definition of model simplicity I propose (and the idea is certainly not original with me) is that the simplest model is the model which is easiest to disprove.

A common illustration of this definition is the model "All crows are black". The model is "simple" in that it can be easily disproved, at least in principle, by finding a white (or red or blue or green) crow. The simplicity of this model does not depend on any particular observations of crow colors, but only on the implication of the model that one or more non-black crows is sufficient to disprove the model. The model is unaffected by any number of observations of black crows, and once a single non-black crow is seen to disprove the model no number of continued observations of black crows can revive it.

Notice here that it is not necessary that the disproving tests be easy to make, only that they be easy to define. I could spend many years looking for non-black crows; the test is defined and can disprove the model, and that alone is sufficient for simplicity.

This definition has two advantages over those previously described. First, model simplicity is independent of observations that may (or may not) be made on the phenomenon the model represents. For example, the simplicity of a growth and yield model for a particular species of tree does not depend on which group of trees are selected for measurement or from which side of the mill the trees are taken. Also, model simplicity is maintained across different sets of observations. A model of economic behavior would have the same simplicity for observations made on the United States economy or on the economy of Mongolia. In one case or the other it may be possible to more easily collect information which would disprove the model, but the model simplicity does not change. The simplicity of the model resides in the model itself; observations have no role in establishing that simplicity.

Second, this definition of simplicity is useful in that it directs attempts to disprove the model. In the example of the crows, the statement of the model shows at the same time the degreee of simplicity and the means to disprove the model. Determining the simplicity of a tree growth model shows what tests can cause the model to be discarded and what observations may be needed to make these tests. This characteristic makes simplicity useful and worthwhile to determine.

However, simplicity by this definition may not be easy to apply. Simplicity for the model "all crows are black" can be determined, but models with more variables and parameters would seem to be another case entirely. One one hand, the more terms and parameters a model has the more opportunities there would seem to be to disprove it and the simpler the model would be. On the other hand, it may be difficult to decide whether the entire model or only one feature has been rejected. In general, the balder the model assertions, the more easily it can be disproved and the simpler it is. In this regard this definition may claim the second definition as a subset, since fewer parameters means more general claims and more simplicity.

Unfortunately, our models necessarily have many parameters (e.g. an individual tree, distance-dependent growth model) and determining simplicity and then using the result will be difficult. But the notion of simplicity as most susceptible to disproof still is advantageous. We can begin to examine our models in the light of simplicity and move toward a core of models that are less often disproved and that may have wide generality.

CONCLUSION

Model simplicity has been defined as least degree, fewest parameters, most probable, and easiest to disprove. My main objection to the first three definitions is their reliance on observations to establish simplicity, although there are considerations of ease of use and applicability of results as well. I suggest the use of model simplicity as easiest to disprove because it is independent of observations, even though application may be difficult.

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Prepared December 15, 1989

THE FOREST DECIMAL CLASSIFICATION (FDC)

A MASTER-PIECE OF IUFRO

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SUMMARY

FDC 945.14

Under IUFRO's sponsorship, Project Group P6.01-00 was able to reactivate the use of the Forest Decimal Classification. 29 more forest institutions have chosen this classification system since 1981.

A survey of the history of the classification from 1954 to 1990 is given and a closer look taken at the system in order to contribute to an improved application.

The compilation of amendments 7 and 8 in English, German, and French, the Trilingual short version, the new German and Slovenian editions of the complete FDC and the resolution for a new name of the Oxford system are presented.

Keywords: Decimal Classification, Documentation System, Forest Libraries
FDC No.: 945.14

INTRODUCTION

"Science in forestry" is the theme of the 19th IUFRO World Congress in Montreal, 1990. The Project Group P6.01-00 could not have asked for a better theme because we have inherited one of IUFRO's longest-running scientific projects, one started at its foundation. We have just finalized an updating of the forest decimal classification and can present a new trilingual short version of the system.

Without the continuous exchange of knowledge and experience between colleagues of several countries, this work would never have been realized in the short period of time from one IUFRO Congress to another.

HISTORY OF THE CLASSIFICATION FROM 1954 TO 1990

Sooner or later every specialist finds himself in the position of having to take over from his predecessor one or more handbooks. These have usualy been compiled through the painstaking work of generations of researchers. Regular updating is essential to maintain their quality at a high standard.

In the 60's there was a mania in Europe for criticizing the old ways, with a wave of know-it-all revolution close on its heels. Even forestry classification was not spared; in the 70's there it was, poor and out of date. It had not been updated for more than 10 years. But were there ever made more new discoveries in forestry research than in those 10 years? Consequently, practical foresters were readily persuaded that the Oxford System was antiquated and no longer useful, particularly in computer applications. The users of the card catalogues at the Commonwealth Forestry Bureau in Oxford were in favour of changing the system. Today, one asks oneself whether the result would have been the same if those in charge of forestry libraries and documentation centres had spoken out before this drastic decision was made. In the 70's S. Schrader, Hamburg, tried to organize a conference of specialists in Wageningen, but there was so little interest that the idea had to be abandoned. Be that as it may, his article in Forstarchiv, 50, 1979, 3: 51-53 caused a complete change in the documentation situation. Why? Because the few large documentation centres would use a different "language" than the many small libraries.

After what had gone before, who would have expected that, at a meeting of IUFRO Group S6.03 in Hamburg in 1979, forestry librarians from England, Finland, France, Yugoslavia, Austria, the Federal Republic of Germany, and Switzerland would suddenly speak out and flatly refuse to abandon the system? Most of the libraries concerned were established over 100 years ago, and which of them could even begin to think of continuing under a new system? No wonder the computer retrieval and communication systems had to be so differently programmed simply because the original systems had not been uniformly designed. Yet users everywhere all have the same needs!

So it was that in Hamburg, in 1979, forestry classification reached another turning point, as it had in 1953. In 1980, with the agreement of Prof. L. Strand, Norway, leader of Division 6, and O.N. Blatchford, England, first leader of our group, an ad hoc Working Party undertook a worldwide survey of the use of the ODC. Everyone was much surprised to learn that, in contrast to widespread information, many of the ODC users were working in the USA and Canada.

At the 17th IUFRO World Congress in Kyoto in 1981, on the initiative of Dr Walter Bosshard, Switzerland, the Executive Board approved the foundation of Project Group P6.01-00 "Revision of the Oxford System", in order to resume responsibility for the control, maintenance, and development of the ODC.

All session papers published between 1949 and 1973 by the Joint FAO/IUFRO Committee on Bibliography and Terminology were studied so as to establish a background based on previous traditions and experiences.

As the Oxford System comprises part of the UDC, it goes without saying that the "Principles of the Universal Decimal Classification (UDC) and Rules for its Revision and Publication" were consulted.

At the 18th IUFRO World Congress in Ljubljana in 1986, we were all extremely pleased to learn that the BFFH in Hamburg had again reintroduced the numerical system.

A CLOSER LOOK AT THE CLASSIFICATION TODAY

It is very important to face the structure of the classification in theory before its practical application can be fruitful. A careful study of the introduction to the classification is essential. A most helpful tool before starting a library, bibliography, or personal file is personal contact with people who have many years' experience.

If a number cannot be found in the classification it is very often because there is not yet enough knowledge of the system. Much consideration and searching is required before the numbers become familiar to the user.

It is well known to long-term users of the system that there are numbers with up to nine digits which are never used in practice. However, because they have been conceived and are a part of the system, they are left to serve, maybe, highly specialized scientists.

Also in the course of time, some sections have been more researched and developed in forestry than others. We believe today that complex cross-reference combinations, which appear more as a mathematical crossnumber puzzle than a bibliographical tool, are outdated, since the computer has replaced catalogue cards. The problem of the number order is eliminated because the computer can find associations of numbers regardless of any others in the sequence allotted.

Many users have experience in the on-line use of numerical subject codes with full text searching and have confirmed that this method furnishes the best results for the requested literature.

It cannot be denied that every living language is subject to changes. Is it surprising that definitions and terms within a single language change within a short period of time? The ever-increasing mass of literature demands the simplest methods of finding the document as quickly as possible.

In many countries the circumstances nowadays demand that forestry be regarded as a part of environmental science. When the forest classification was designed, around 1900, and completely revised around 1950, the authors of the manual were so far-sighted that there is no field related to forestry that is not or could not be incorporated into it.

However, forest libraries very often have to collect also non-forestry literature such as books on chemistry, computer science, and management. This literature, compared with that classified in the FDC, is nevertheless small. Given this situation, the Universal Decimal Classification (UDC) may help complete the FDC. Also for the auxiliary numbers of form and place, the UDC is the classification to choose if a more detailed subdivision is needed.

If the direct FDC or UDC classification numbers are not chosen as signatures, because they are difficult to file, the following system of signature for books, reprints, slides, prints, etc., is applied in many countries and should be understood as proposal:

FDC	UDC
00 General	000 General
10 Factors of the environment	100 Philosophy
20 Silviculture, etc.	200 Religion

Example for the filing

20/13

concerning the subject FDC 2	the 13th item within silviculture

If the collection represents many thousand items, more detailed filing is required:

FDC

11 Site factors
12 General biology
13 General zoology, etc.

More and more books and series issues are dealing with several fields at once because they are symposium proceedings, collective works or memorial papers. Consequently, classification is often a matter of judgement. For this reason the signatures in use today should be kept rather broad and simple than detailed.

Many librarians who work regularly with the classification have put the pages in a ring-book. It is easier then to add personal notes, and if necessary domestic subdivisions.

FROM THE ACTIVITIES OF THE PROJECT GROUP P6.01-00

Main activities were the compilation of amendments 7 and 8, the Trilingual short version, a new edition of the German and Slovenian complete FDC, and the resolution concerning a new name for the Oxford system.

a) The Amendments 7 to 8

One of the first tasks of the Group was to publish amendment no. 7 with numbers for new concepts discovered in forestry research between 1968 and 1981. It was most desirable to publish all the amendments in one sequence not only in a systematical list, but also in an alphabetical index. They were published in English, German, and French:

Amendments 1-7.	IUFRO News, No. 40 (2/1983): 5-10.
Verbesserungen 2-7.	IUFRO News, No. 46 (4/1984): 14-19.
Amendements 3-7.	IUFRO News, No. 65 (4/1989).

Forestry research had again conceived so many new concepts that in 1985 it became necessary to think of an 8th amendment. It has also been published in English, German, and French:

Amendment 8 and Verbesserung 8. IUFRO News, No. 61 (4/1988).

Amendement 8. IUFRO News, No. 65 (4/1989).

To finalize all these amendments, meetings of the Group's Committee were necessary 1982 in Vienna, 1983 in Farnham, 1988 in Vienna, 1989 in Ljubliana, in order to consult relevant forest specialists.

The procedure for the expansion of, and amendments to, the system were published in: 18th IUFRO World Congress; Division 6; Proceedings, p. 422-431. Vienna: IUFRO 1986.

Those who wish for more information on the background of the forest classification should consult: The Systems of decimal classification for forestry "Flury" and "Oxford", a bibliography, 1903-1987, compiled by Regina Schenker. In: Mitteilungen der Gesellschaft für Bibliothekswesen und Dokumentation des Landbaues, Heft 42, S. 5-18. Stuttgart-Hohenheim: GBDL 1988.

b) The Trilingual Short Version

Is there any collection or filing system today which does not involve more than one language? The three official languages of IUFRO were chosen for the short version at the special and repeated requests of its members.

The Committee has decided to work out a trilingual manual to the level of three digits. Those who need a more detailed classification should refer to the complete version of the system, published in 16 languages.

An enormous effort was made to update all appendices of the classification because of their importance in classification work. This was particularly true of the auxiliary numbers of place.

The compilation of the tree list, for example, presented such difficulties regarding the selection of trees to be included that at one time we could literally no longer see the wood for the trees. We realized that it was impossible to satisfy all IUFRO member countries, and our thanks go to all for their appreciation of our difficulties.

c) A New Edition of the Complete FDC

The Group is aware that nearly all official editions of the complete FDC, published between 1953 and 1966 or some reprinted at a later date, are today out of print.

Only a compilation of all amendments 1 to 8 published between 1956 and 1989 made it possible to take in hand a new edition of the FDC. With the help of the Group the forest institutes of Vienna and Ljubliana are the first who can present today the German and Slovenian version. It is, of course most desirable that other IUFRO member countries should follow soon, especially those with official FDC editions.

d) Change of the Name

For many reasons it was high time to change the name "Oxford System of Decimal Classification for Forestry".

The predecessor of the Oxford system, the Flury system, was applied from 1933 to 1953. It was replaced by the Oxford system in 1954. The Joint FAO/IUFRO Committee on Bibliography and Terminology published amendments between 1957 and 1967, and in 1971 the Committee under its then current name was dissolved.

In 1973, at the new Committee's last session, IUFRO was asked to assume responsibility for the classification. It was only in 1981 that the IUFRO Project Group P6.01-00 was founded to continue with this task.

In 1988 the IUFRO Executive Board approved the resolution of our Committee for the following reasons:

- Simplification of the complicated and old-fashioned name.
- On first being printed in 1933 the classification was called "Forest Bibliography" but became known widely as the Flury system. Its name was changed to the "Oxford System of Decimal Classification for Forestry" because the Commonwealth Forestry Bureau presented a completely revised classification in 1954.
- The Commonwealth Agricultural Bureaux, publisher of the English Oxford system, does not use it any more and therefore no longer updates it.
- There is no longer any relation to the name Oxford.
- In 1981 IUFRO officially took over responsibility for the classification.

CONCLUSIONS

a) Resolution of the Group

After many years of intensive collaboration, the classification is once more updated. The new edition of the complete versions of the German and Slovenian FDC, and the FDC Trilingual short version result from regular, not occasional team work.

It is very much to be hoped that the national activities should fo-low the international ones and that, with priority, the English, French, Spanish, and Italian editions should be taken in hand soon.

In 1979, the active members of Subject Group S6.03 withdrew definitely from classification work because of their terminology burden. IUFRO has heard many discussions on this theme. A most valuable study about decimal classification and terminology work can be found in the introduction to the Universal Decimal Classification (UDC) by Dr Karl Fill.

Today S6.03 and P6.01 have some similar tasks and problems. In 1989 members of both groups suggested that they amalgamate. However, we think our approach to the product is quite different. One group works with words, the other works with numbers. In many ways, our training and our daily work have a different background, a different structure. We feel a regular exchange of knowledge and experience to be more fruitful, if the groups continue to work separately, at least for the next five years.

b) Collaboration Means Improvement

In 1979, at the beginning of the Group's activities, the enthusiasm for collaboration was promising. Without doubt, forest librarians are overloaded with mountains of documents to be put in order every day, and foresters complain of too great a burden of administrative and public relations work. But it is obvious that every experienced FDC user of IUFRO can make a contribution supporting the Group's task.

The more suggestions, contributions, and improvements the Committee receives for consideration, the better it can reach decisions valid at the international level. Is it surprising that those institutions and persons who support the Committee regularly criticize the FDC much less?

Today the FDC is applied in 60 countries. From 1981 to 1989 the Group increased by 29 members from 153 to 182, namely 22 in Africa, 23 in Asia, 14 in Australia, 85 in Europe, 31 in North-America, and 7 in South-America, all using the same classification.

It is not only an aid for forest libraries and documentation centres, for publishers of periodicals, vocabularies and bibliographies, but also helps foresters, forest scientists, and students to keep their personal records in clear order. The numbers can always be chosen in the largest or narrowest sense. One of the most important features of this system is that its hierarchical structure is based on an easily memorized frame work, which together with the concomitant numerical system renders exchange of literature very easy.

No library, no bibliography, no personal filing system can be organized without classification. In some way each of their roles is always closely connected to the other. If they are built up with the same "language", it is much easier for the user to find the document. Their value is the result not of years, but of decades of practical experience. This had - and still has - to be repeated over and over again.

c) Support from IUFRO

Over the past ten years considerable support has been received from the Forest Research Institutes of Switzerland, Austria, France and Yugoslavia. In the future, the members of the Group's Committee can only fullfill their task if their own institutions as well as the IUFRO Executive Board recognize the necessity of international contact keeping the classification updated.

To reduce the forest knowledge of nearly 100 years from different people in various countries using varying languages to a common formula must be respected as a master-piece of generations of specialists. If the use of terms varies even from one generation to another, or between one silviculturist, entomologist, plant sociologist, etc., to his colleague, how can anyone demand of their classification to be perfect?

Many people involved in forestry know about the unique heritage of this classification. In the rythm of discoveries to renew forest sciences, naturally the classification should be under constant supervision of IUFRO and its member countries, and be updated regularly by Project Group P6.01-00. Only then can it become, and remain, a useful tool for its members. The FDC will always reflect the advances in forest research.

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See page 5 of the article

Prepared December 1989

Appendix 1

THE EDITIONS OF THE OXFORD SYSTEM AND ITS AMENDMENTS

The Oxford system was to be translated into 16 languages and employed by all important forest literature organizations. In 1985 confirmation by the editors of all editions was requested and received.

Official editions

1954 The Oxford System of Decimal Classification for Forestry. Farnham Royal: Commonwealth Agricultural Bureaux 1954 (ib.81). 115 p.

1957 Das Oxford-System der Dezimal-Klassifikation für Forstwesen (Forst- und Holzwirtschaft). Freiburg i.Br.: Deutsche Zentralstelle für forstliche Bibliographie 1957. 110 S.

1959 Sistema Oxford de clasificación decimal para bibliografia forestal. Madrid: Comisión española de bibliografia y terminologia forestal 1959. 133 p.

1960 Système de la classification décimale d'Oxford pour les sciences forestières. Nancy: Ecole nationale des eaux et forêts (1960). 234 p.

1962 Sistema di classificazione decimale di Oxford per la bibliografia forestale. Firenze: Accademia italiana di scienze forestali 1962. 110 p.

1964 Sistema de classificação decimal de Oxford para a bibliografia florestal. Lisboa: Direcção-Geral dos Serviços Florestais e Aquicolas 1964. 127 p.

1966 Oxfordsystemet för decimalklassifikation av skoglig literatur. Stockholm: Kungl. Skogs- och Lantbruksakademien 1966. 122 p.

Unofficial Editions

Dutch	1952	Japanese	1973
Turkish	1954	Polish	1973
Czech	1957	Russian	1977
Hungarian	1957	Finnish	1978
Slovenian	1960 (ib.75)		

Appendix 2

THE AMENDMENTS 1 TO 6 COMPILED BETWEEN 1957 AND 1968 BY THE JOINT FAO/IUFRO COMMITTEE ON BIBLIOGRAPHY AND TERMINOLOGY

These have been published in English, German and French:

Forestry Abstracts	Unasylva, engl.
Amendment 1: 18, 1957: 1	11, 1957, 3: 125
Amendment 2: 19, 1958: 4	13, 1959, 2: 104-105
Amendment 3: 21, 1960: 3	14, 1960, 4: 198
Amendment 4: 24, 1963: 4	18, 1964, 1: 17
Amendment 5: 27, 1966: 3	20, 1966, 4: 28
Amendment 6: 29, 1968: 2	22, 1968, 1: 9

The English reprint of the Oxford system in 1981 comprises a consolidated list of all these amendments.

Allgemeine Forst- und Jagdzeitung

Die Verbesserung Nr. 1 ist in der Hauptausgabe schon berücksichtigt.

Verbesserung 2: 130, 1959: 56

Verbesserung 3: 131, 1960: 216

Verbesserung 4: 135, 1964: 84

Verbesserung 5: 137, 1966: 168

Die Verbesserung Nr. 6 ist das unveröffentlichte Exemplar der BFFH Hamburg, aber autorisiert von der FAO und der IUFRO.

Unasylva, français

Amendement 1: 11, 1957, 3: 131-132

Amendement 2: 13, 1959, 2: 104-105

Amendement 3: 14, 1960, 4: 198

Amendement 4: 18, 1964, 1: 17

Amendement 5 est l'exemplaire inédit du CFB, Oxford, mais autorisé par la FAO et l'IUFRO.

Amendement 6: 22, 1968, 1: 9

Les amendements 1 à 2 sont déjà intégrés dans l'édition française.

THEORY AND PRACTICE IN THE FOREST DECIMAL CLASSIFICATION

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FDC: 945.14/.15 (497.12)

ABSTRACT

The Forestry Library was founded in 1948 in Ljubljana. Its documents were at the beginning classified with the Flury System and later, after remodelling with The Oxford System of Decimal Classification for Forestry (1966). The entire documentation - information (INDOC) service of the library was and is built up with ODC. Now, it goes over from manual to computer technology with the amendments 1 to 8 and with the new name: Forest Decimal Classification (FDC).

Key words: Forestry library, Flury system, INDOC Service, ODC, Amendments, computer technology, FDC

FDC 945.14/.15 (497.12)

INTRODUCTION

My country of Slovenia is one of the six republics of Yugoslavia. It is situated in Central Europe on the threshold of the Adriatic Sea and the Balkans. It is not a large country: with an area of about 20.000 sg.km., it has approximately 1.900.000 inhabitants of which 90 % are Slovene. The Slovenes are an old nation with a thousand year old cultural tradition, with an own language.

Our forests are significant, 51 % of the Slovenian area is afforested, ranging from the lowlands (continental and coastal areas) to the upper forest line in the Alps and Dinarid mountains.

Research into forests on Slovene lands started with forestry research as in other parts of Europe, initially in the context of the Austrian and Austro-Hungarian monarchies of which, the Slovene lands in Istria were a constituent part. Early such text were mostly written in German; the first professional forestry treatise in Slovene was written in 1821 and the first publication was published in 1869.

After the second world war forestry and wood technology were jointly organised. In 1947, Slovenia was divided into 14 forest management regions (territorial-organisational units). One forest management and one wood industry firm was created in each area. Forest management regions include both socially-owned (40 %) and private (60 %) forest.

In order to prevent unprofessional felling in the forest and to replace professional cadres the following institutions were founded:
1947 the Forestry Institute of Slovenia, for professional and scientific research,
1948 the Forestry secondary school/high school, today the Forestry Education Center in Postojna for theoretical and practical training in forestry techniques,
1949 the Forestry Department at the University of Ljubljana to qualify graduate forestry engineers, primarily for the needs of Slovenia.

The central library for forestry and wood technology was organised at the Forestry Institute for Slovenia in 1948 in Ljubljana.

THE FORESTRY LIBRARY AND THE FOREST DECIMAL CLASSIFICATION SYSTEM

At its inception, the library had only about 2500 books and 38 periodicals. Its primary task was collecting, processing, arranging and preserving documents in the field of forestry and wood technology, and of providing information.

The material of the library was arranged according to modern development trends in forestry and wood technology. The first librarian thus classified the modest material according to the Flury System. This was the first forestry decimal classification system which, under the name "Forest Bibliography" was accepted in 1933 by the International Union of Forest Research Organisations (IUFRO). Forestry literature was classified in order to exchange bibliographical tools on an international level.

Forestry science had made great progress by the end of the second world war, especially in the fields of wood technology and forest economics and the classification system needed revision. Under the guidance of the Joint FAO/IUFRO Committee on Bibliography and Terminology the Flury System was remodelled at the Commonwealth Forestry Bureau, Oxford along the lines of the Universal Decimal Classification (UDC).

The modernised classification system was first accepted at the 11th IUFRO World Congress and 7th FAO meeting in Rome (1953) with the recommendation to be adopted by all forestry libraries, documentary centres and institutes in member countries - and the requests that the Joint FAO/IUFRO Committee on Bibliography and Terminology should revise the accepted classification from time to time and adjust it in accordance with requirements, and that it should continue negotiations for incorporation of the new system into the UDC.

In 1954 the Oxford System of Decimal Classification for Forestry (ODC) was published, and became known internationally as the Oxford System. The original in English was translated into a considerable number of languages, and in 1960. had the first Slovene translation.

In the mid sixties, it was considered necessary to include the collection of books from the Forestry-Wood Technology Department of the Biotechnical Faculty of the University in Ljubljana in the Institute library, other to have one forestry wood technology library. Forestry theoreticians and practitioners welcomed this change, also in respect of professional scientific development. The documents were reorganized with the new ODC system. Considerable help was received by Prof. Dr. Dusan Mlinsek.

It was necessary to reclassify, re-label, rearrange on the shelfs, in the catalogues, and to provide a new alphabetical and systematic catalogue with the ODC. Young graduate forestry engineers of the Forestry-Wood Technology Department and the Institute assisted in the reorganization. It took four years to update the library collection grown up by now to 11500 units and 183 periodicals. The library was again inaugurated in 1970.

However it was still necessary to bear in mind the ongoing classification of documents and the provision of information by theme to users. Many discussion were necessary, who could carry out this work at a satisfactory level. Since the reorganisation, there had been only a senior librarian with general knowledge which was inadequate for this kind of work. A qualified documentalist, with good knowledge in forestry and its decimal classification and of course with language facilities, was necessary for this task. Our INDOC activities began in 1975 with qualified man.

INDOC SERVICES WITH THE ODC

The entire documentation-information service of the Forestry Library was built up with the ODC. Manual completion of catalogue cards, arrangement of the catalogues and making searches through them was very time-consuming work. However, it was necessary for more than fifteen years to keep users adequately informed about forestry literature at home and abroad.

Cards were established for all books and special professional material as degree work, master theses, doctoral dissertations, research projects, professional reports. For non-forestry work used and still use the Universal Decimal Classification.

Bibliographic catalogue of our 50 scientifics was prepared. For more important papers we even completed analytical cards containing, in additional to bibliographical data on ODC lines, key word and abstracts to arrange them in a catalogue of analytic information (alphabetic and systematic).

In additional we obtained documentation cards from the British INDOC center, CFB, Oxford, which were completed with ODC code numbers and abstracts to be arrange in systematical and alphabetical catalogue from 1971-1977.

We dispatched data of important Slovene and other Yugoslav forestry professional works to the Forstliche Bundesversuchsanstalt in Vienna, with key words in German (1981-1985) and ODC code numbers. In exchange we received and still receive their entire collection on cards.

We search and disseminate information with ODC based referenced newspapers (Forestry Abstracts; Forstliche Umschau; Rž Lesovedenie i lesovodstvo; Bilten dokumentacije. Serija a: Sumarstvo), etc.

We classify articles for both Slovene forestry journals with the ODC: Zbornik gozdarstva in lesarstva (Reports of forestry and wood technology) and Gozdarski vestnik (Journal of Forestry. We disseminate knowledge of end experience with the Oxford system to other Yugoslav forestry libraries.

THE ODC SYSTEM AND COMPUTER TECHNOLOGY

Then computers came. The elaboration of library and documentation cards was suddenly no longer so painful and slow with computer facilities. But this situation brought disagreement among users with the ODC.

Large forestry INDOC centres e.g. CFB, Oxford, Documentationsstelle BFH, Hamburg decided that with the computer preparation of and search for information, the ODC was no longer appropriate. They abandoned it in favour of key word systems (descriptors).

Small libraries and INDOC services from many countries were confused by this, since the option wasn't really open to them and they decided to continue to use the Oxford system. We also were among them.

Small INDOC services formulated their doubts in consultation with the IUFRO professional group S 6.03 Information systems and terminology in Hamburg in 1979, and consequently had to organise a project group P 6.01-00 with an initial task of canvassing the opinions of ODC system users throughout the world. This task was followed by improving the system.

Between 1981 and 1989 the project group published the amendments 1 to 8 in English, German and French. At the 18th IUFRO World Congress in Ljubljana in 1986, we received the most coveted of awards for the meticulous work: the acknowledgement of the doyen of forestry documentalists, Siegfried Schrader, and FDC teacher of our present group leader who after five years of indexing documents at the BFH Dokumentationsstelle, Hamburg, with key words , decided to return again to the decimal classification system.

The Oxford System of Decimal Classification for Forestry experienced a renaissance with the amendments and it was in fact ready now for the use with computer technology. Large forestry INDOC centres are using it, today.

INFORMATION NETS FOR SCIENCE AND TECHNOLOGY IN SLOVENIA

In Slovenia we have specialized INDOC centres for particular fields of science (biomedicine, electronics, chemistry, engineering, etc.), which are linked through a business association for scientific and technical information. Many of them are directly (on-line) connected with large European (e.g., DIMDI) and American (e.g., DIALOG) host bases and they thus have access to the major international data bases.

The computer centre of the University of Maribor is host for all domestic bases: it is possible to get on-line directly with it. At the same time it has also been chosen as host on the federal Yugoslav level for the library mutual catalogue.

CONNECTION TO THE BIOTECHNICAL INDOC CENTRE

The Biotechnical Faculty containing various fields of applied biology, surch as biology, agronomy, forestry, wood technology, veterinary, food technology and animal husbandry. INDOC services of the individual departments and the Agricultural Institute of Slovenia include in the Biotechnical INDOC Center.

The forestry INDOC service is a part of this INDOC center too. Because wood technology became independent in 1978, the forestry library has ever since remained specialized only in forestry science and it is the only service in Slovenia of this kind. Forest management regions have smaller reference libraries which however are connected in a forestry library network.

Together with all services of the Biotechnical INDOC Center, we obtained an ATARI 520 ST+ computer and the STEVE program at the end of 1986.

PLANS OF THE FORESTRY INDOC SERVICE

Since we were happy with the improved ODC system adopted at the 18^{th} World IUFRO Congress in 1986 and the transition of the INDOC center at Forstliche Bundesversuchsanstalt in Vienna by computer preparation, we also decided to modernise our work as following:

We began to prepare the library catalogues with the aid of the ATARI computer. Of course we continued to classify all documents with the ODC. At the same time, we indexed all bibliographies and documents written in Slovene, with Slovene key words and English ones if necessary. In this way the library catalogues are constantly growing and we are prepared to build up a Slovene forestry data base which will include the current catalogue of bibliographies and analytical information and all work in the field of forestry written in Slovene, monographs, articles, reports.

As we use ODC code numbers and key words in English too, we plan to include our data bases in international forestry data bases. Key words in Slovene and AGRIS codes probably be included in the common data bases of the Biotechnical INDOC Center and onwards to the host Slovene data bases at the Computer Center at the University of Maribor.

In order to ensure completion of these plans, we had to decide first about the following points:

- Make a good Slovene translation of the Oxford System of Decimal Classification for Forestry, including the amendments 1-8;
- Improve this list of Slovene key words with has to correspond to the terms of forestry terminological committee;
- Better instruction of the ODC to foresters;
- A regular employment of a graduate forestry engineer as documentalist, in addition to be library leader, who will prepare data for input and look after the Slovene Forestry data base and its dissemination of information;
- The purchase of a PC - since it is compatible with the family of IBM computers. With its help, we can be included into information networks;
- A good program for the computer according to our needs;
- A regular help from computer specialist;
- Occasional help from technicians for the input of data.

THE FOREST DECIMAL CLASSIFICATION (FDC) GOES ON-LINE IN SLOVENIA?

Within three years from 1987 to 1989, we have succeeded in most of the preparatory work. The most difficult task was the translation. System had changed its name in 1988, into modern professional Slovene and putting the entire system into the computer. Twenty six Slovene forestry and wood technology professionals from the University and Institute, specialists in particular scientific fields, responded gladly and took part in this task. The author of the present text coordinated the work and ensured that the translation was adequately language edited. A computer specialist made a program for the input of the entire FDC into the PC and for the computer output of an alphabetic list of professional term. This work took two years. Researchers are prepared to update the key words by indexing their own documents as e.g. bibliographies etc.

We conduct regular courses on informatics for students in forestry within a regular education program. The courses for forestry researchers include lectures on the use of the FDC and it is presented with practical demonstration on the computer.

We have obtained a PC ABAKUS computer with the ISIS program. The latter is property of the UNESCO. Our programmer has translated the instructions in Slovene. In additional to the above stated bases, a new data base for slides DIATEKA has been created at the Institute, which is also based on the FDC.

Since we have permanently a documentalist, four professionals have been employed in the library: two senior librarians and two documentalists. We are assisted by computer specialists.

OUTLOOK

In the near future, we will update our forestry data base and ensure its inclusion in the Yugoslav net of scientific information. The following services are alreddy in preparation.

1) A data collection of the Library Catalogue which has been made on ATARI since 1987 will become transferable and compatible with the gradually emerging forestry base on PC.
2) The manual organisation of the documentary cards of our library will be ceased.
3) The documentation of the FBV in Vienna will be arranged directly on-line.
4) Maybe we connect with forestry other center or hosts and bases abroad which also work with the FDC.

Maybe the realization is not for away that our researchers of their bibliographies in the unified computer pattern. We at the forestry INDOK service can then supplement this information to make it accessible for others.

The up-dating of a 100 years old forest classification is time consuming and hard work for researchers, translators, documentalists and librarians. In my country many of the people involved in this change have collaborated as muc as possible because to ensure again a improved information for the next decades.

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Voluntary Paper Summaries
Résumés de communications non sollicitées
Zusammenfassungen der unaufgefordert vorgelegten Beiträge
Resúmenes de Ponencias presentadas voluntariamente

Voluntary paper summaries have been arranged in alphabetical order of authors' names.
Les résumés de communications non sollicitées ont été disposés par ordre alphabétique des noms d'auteurs.
Die Zuzammenfassungen der unaufgefordent vorgelegten Beiträge sind in alphabetischer Reihenfolge der Autoren aufgeführt.
Resúmenes de Ponencias presentadas voluntariamente dispuestos por orden alfabético de los nombres de los autores.

STRUCTURAL MEANING IN THE VISUAL FOREST LANDSCAPE: ASSESSMENT AND MANAGEMENT IMPLICATIONS

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FDC: 907.1: 903

Forest policy regulations in indutrialized countries provide for the consideration of landscape aesthetic attractiveness and the public 's visual expectations. Under the pressure to develop operational methods for assessing the quality of the visual resources, the more complex issues of what landscape images are, and what sort of meanings convey, are generally avoided by current assessment methods. Yet, the meaning of landscape images may be important determinants of aesthetic response.

Many landscape architects share the intuition that form, meaning, and value are somehow connected in the visual landscape, but strong empirical support is lacking. The relation between expression or form to content or meaning, has been systematically studied by approaching landscape images as semiotic acts, a special operation of sensory signs referring to another reality that they are supposed to evoke.

The validity of the semiotic approach has been confirmed after presenting formal variations of the same lexical unit (in forest views) to observers (over 200) with different study interests in Spain and the United States. Observers were asked to elicitmeanings, and to evaluate the difference in expression (explicit versus vague) communicated by 27 photographic images of hardwood forests in New York State.

When different people, without communicating, come up with similar dimensions through which judgments of meaning are made, the distinction between 'structural' meaning and 'lexical' meaning can be established. As for any sign language, structural meaning refers to the syntactical rules that generate meaningful expressions from a plurality of signs, subject to restrictions of their combinations. The initial findings indicate high reliability values for judgments of structural meaning; significant correlations between physical variables and semantic performance suggest potential management rules to foster the generation of meaning in the forest landscape.

STATUS OF FOREST TREE SEED RESEARCH IN INDIA

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FDC: 232.31--01: (540)

Studies in seed technological assessment of forest tree species assumed importance only with the advent of recent increase in tree planting and the realisation of seed quality variation at all levels. In the developing countries like India, massive afforestation programmes has lead to increased demand for quality seed. But in reality the quality aspect has been overlooked due to lack of research background. Hence, an attempt has been made to review the research in the past on seed improvement and quality evaluation in tree species.

Information has been gathered exhaustively on the status of physical and genetical purity, germination methods, vigour and viability tests, dormancy, seed health and critical/storage conditions of tropical and sub-tropical species. The causes for seed deterioration at all .the stages of seed movement have been throughly highlighted. It is stressed that there is a long way to go for implementation of seed certification and law enforcement to ensure fair seed trade and certification procedures as well as seed standards. An overall information is collected about the responsible organisations, their recommendations and government response in this regard. A review of proceeding of all the meetings pertaining to forest tree seed at national and provencial levels has been presented.

The authors felt that seed research on forest tree species all over the country needs co-ordinated efforts of research workers to identify thrust areas and intensify systematic research work. It is suggested to formulate seed testing practices, registration, varification, processing, storage, transit and validation procedures based on the research findings in India and elsewhere, as an immediate step.

JAGDKULTUR IN TAIWAN -- LANGFRISTIGES FORSCHUNGSVORHABEN UND GRUNDKONZEPT

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FDC: 156.7: (51)

In der ca. 5,000jährigen China-Geschichte ist die Jagdkultur nicht vertreten. Alte Literaturen enthalten, außer in mytischer Weise, kaum Beschreibung über Wildtiere bzw. Beziehung zwischen Wildtieren und Menschen. Gegenwärtig steht das Wild zwar vielfach im Mittelpunkt der Wildforschung in Taiwan und Festlandchina. Sie ist jagdkulturell doch nur teilweise relevant.

Der Terminus "Jagdkultur" existiert in der chinesischen Sprache nicht. Er wird definiert wie folgt: Sämtliche Beziehungen zwischen Wildtieren und jagenden Menschen während der Entwicklung menschlischer Lebensweise. Dabei erstreckt sich das Wort "jagen" begrifflich vom Beutemachen bis hin zur Wildhege, also auf jede materiell und immateriell motivierten Handlungen.

52% der Inselfläche als Waldfläche bei außerordentlichem Wildreichtum einerseits, und 9 Stämme umfassende Bergbewohner mit bis in die Gegenwart währender, jagdkulturell ursprünglicherer Lebensweise andererseits geben Anlaß dazu, die letztmögliche Gelegenheit zur Erforschung der Jagdkultur verschiedenen Entwicklungsphasen in Taiwan wahrzunehmen.

Die Ausarbeitung des Inhaltes von Jagdkultur legte den sachlichen Umfang des Forschungsvorhaben zugrunde. 15 Sachgebiete mit über 60 Themen beinhalten das vorläufige Forschungsvorhaben. Jäger älterer Prägung, die um 90 im Alter und wenig an Zahl sind, bezeugen die jagdkulturelle Vergangenheit. Dies räumt ihnen absolute Periorität ein, sich sofort an die 1. Forschungsphase heranziehen zu lassen. Die letzten 40 Jahre untersucht die 2. Phase, ihr folgen die 3. und 4. mit dem Ziel, alte chinesische Literatur zu bearbeiten und Ergebnisse mit den Ausländidischen zu vergleichen.

1987/88 fand die Voruntersuchung statt. Das Ergebnis wurde teilweise veröffentlicht. Ersichtlich daraus vorallem wurde der Zeitbedarf für die 1. Forschungsphase. Je ein Team für ein Thema vorausgesetzt, beträgt dieser mindestens 10 Jahre. Ohne internationale Beteiligung, ist dieser wohl nicht zu verwicklichen. Das käme einem Verlust des Kulturgutes der Menschheit gleich.

Forschungsfördernde Institutionen Taiwans sehen z.Z. internationaler Zusammenarbeit gern entgegen und sind geneigt, dieser mit gewisser Finanzhilfe beizustehen. Fachleute im Fache wie Forstwissenschaft, Wildbilolgie, Wildlife-Management, wie aber auch Geistwissenschaftler wie Anthropologe, Kulturgeschichtsforscher u.a.m. sind dazu angesprochen, gemeinsam an diesen langfristig angelegten Forschungsprojekten zu arbeiten.

A STUDY ON AGE CLASS DISCRIMINATION OF CRYPTOMERIA WITH GREENNESS INDICATORS

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SUMMARY

FDC: 161.32: 559: 174.7 Cryptomeria japonica D. Don

Literatures indicated that the reflection radiation, in the visible and infrared regions, from a vegetation canopy is strongly correlated to the dry matter accumulation of a plant. The ratios or linear combinations of red and near-infrared, greenness indicators, are frequently utilized as an indicator in growth estimation. The greenness indicator changes with tree or crop foliage development or senescence. In other words, the ability of vegetation biomass accumulation is related to its age.

The purpose of this study was to determine if greenness indicators could be used to discriminate tree age class in Cryptomeria (Cryptomeria Japanica) stands. Prior to tree age class discrimination, the optimum reflection measurement time, best observation position, and highest reflectance tree were determined. Reflectance data of ten trees were collected with a Hand Held Ratioing Radiometer (HHRR) in four wavelength bands, 0.5-0.6μm, 0.6-0.7μm, 0.7-0.8μm, and 0.8-1.1μm in different measurement times, different observation positions, and different stands. Greenness indicators, i.e., ratio vegetation index(RVI), normalization difference(ND), and three greenness(GR_1, GR_2, GR_3) and their reciprocals were calculated for data obtained with the HHRR. A statistical Analysis System (SAS) package was used to analyze the reflectance data and to develop nine multiple regression equations. Analysis of the collected data, resulted in the following four conclusions : (1) Optimum reflection measurement time was 11.00-12.00 hours. (2) Best observation position was at nadir viewing (0°) position. (3) Medium age class trees had the highest spectral reflectance ability. (4) All the nine greenness indicator curves could be used on separating tree age class.

Keywords : Greenness indicators, ratio vegetation index, normalization difference, greenness.

AN EVALUATION METHOD FOR THE DETERMINATION OF FOREST RECRATION POTENTIAL

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FDC: 907.2

The method is based on the weighted scores to be given to the five elements namely landscape value, climate value, accessibility, recreation facilities, and negative factors available in a forest recreation area. The simple formula of the method and the scoring table (weighting scale) are as follows:

$$Lv + Cv + A + Rf + NF = RP \%$$

Symbol	Element	Maximum Points (Element Weightings)
Lv	Landscape Value	35
Cv	Climate Value	25
A	Accessibility	20
Rf	Recreation Facilities	20
NF	Negative Factors	0 (Minimum -10)
RP %	Recreation Potential (%)	100

A Forest Recreation Evaluation Form that shows the detailed characteristics of each element has been prepared. As the highest score would be hypothetically maximum 100, the total of the obtained points of the elements in this form would show the percentage of the forest recreation potential of an area in question particularly for picnic and camp activities.

The following grading system can be suggested according to the results taken from the method:

1. Forest Recreation Potential very low (lower than 30 %)
2. " " " low (30 % - 45 %)
3. " " " average (46 % - 60 %)
4. " " " high (61 % - 75 %)
5. " " " very high (over 75 %)

The method that is most suitable especially for picnic and camp sites, has been developed mainly for the forest recration areas in Turkey. However, the method needs to be further developed in order to determine recreation potentials for a large number of forest recreational activities.

The suitability of the method for forest recreation and camp sites has been recently discussed in a seminar held by the Turkish National Park Service. The participants in the seminar took a great interest in the method, and they suggested that the method should be used especially for picnic and camping activities in forest recreation areas.

THE MODERNIZATION OF COMMON FORESTS IN JAPAN

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FDC: 928: 944: (52)

The Forestry Basic Law of Japan was formulated in I964with special emphasis on overcoming the pettiness of business forest owners were engaged in. One of measures which were worked out was the reorganization or the modernization of hamlet forests or common forests to aquire ownership by private rights. Common forests which accounted for about 2million hectares were dispersed throughout the country.

Activities for the Promotion of Common Forest Consolidation were started in I966, aimed at promoting agricultural and forestry utilization by altering the relationship of rights concerning common forests. The first and second periods of the Consolidation Promotion Project were concluded, and the third period was started in I987. By I985, 479 thousand hectares had been consolidated, details of which are as follows:

Before consolidation

Joint use	I42 thousand ha;	Partitioned use	I35 thousand ha
Direct use	I83 thousand ha;	Contracted use	20 thousand ha

After consolidation

Individual management	I83 thousand ha
Corporative management	298 thousand ha

of which 2629 Forest producers'cooperatives manage 268 thousand ha, while 79 agriculturalproducers' cooperatives manage 54 thousand ha.

Originally the hamlet forest is the least oriented to management and most aimed at accumulating stock among the various owned forests. However, in the late I960's, the local inhabitants were eager to modernize their common forests by forming the forest producers' cooperatives, coping with the marked tendency to leave the villages due to the rapid economic growth.

But after I975 the conditions controlling the management of the forest producers' cooperative deteriorated. After I980, to make matters worse, silviculture became less and less profitable based on the decline of the price of stumpage. Under such circumstances, the advantage of their existence are underestimated and the disadvantages are emphasized in recent years. The modernization policy of common forests is being reconsidered.

IMPORTANCE DE GUIERA SENEGALENSIS POUR L'APPROVISIONNEMENT ENERGETIQUE D'UN VILLAGE DU BASSIN ARACHIDIER SENEGALAIS

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FDC: 831.1: 176.1 Guiera senegalensis Gmell

Dans le Bassin Arachidier sénégalais le village de Khayes a été choisi pour cette étude. Avec une densité de 90 habitants par km^2, une pluviométrie de 450 mm, des cultures continues sans jachères et un peuplement ligneux de moins de 5 arbres/ha, on peut se poser la question de savoir d'où provient l'approvisionnement énergétique du village. D'autant plus que la comparaison de photographies aériennes à grande échelle n'a pas montré de régression sensible, en 15 ans, du peuplement forestier si ce n'est un accroissement de l'émondage lequel ne peut satisfaire aux besoins du village.

Dans ce contexte, Guiera senegalensis Gmell. (Combretaceae) est un arbrisseau qui chaque année est recépé pour faire place aux cultures et qui repousse avec une vigueur étonnante au cours de la saison sèche. Le bois exploité chaque année lors de la préparation des champs est de petites dimensions mais est rassemblé en fagots pour alimenter les foyers des cuisines.

Pour estimer la part de cette espèce dans l'approvisionnement énergétique, l'exploitation de 10 placeaux aléatoires de 400 m^2 chacun a été effectuée et a montré une production en matière sèche de 391 kg/ha (+/- 110 kg/ha) pour les feuilles et les brindilles et de 224 kg/ha (+/- 80 kg/ha) pour le bois utilisable à des fins énergétiques.

Extrapolée au niveau du village cette production de bois représente de 36,4 à 76,9 tonnes/ha/an. Mais en raison d'utilisations alternatives diverses ou de manque de temps pour une récolte complète, nous estimons la consommation en bois de feu de Guiera senegalensis à environ 28 T/an. Comparée à la demande en bois de feu qui est de 62 T/an (270 kg/habitan/an) on constate que Guiera senegalensis intervient pour satisfaire près de 45% des besoins. Le solde étant fourni par l'émondage des arbres, les résidus de récolte et parfois la bouse de vache.

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* Etude menée à la Direction des Recherches sur les Productions Forestières de l'ISRA - BP 2312 - Dakar - Sénégal.

INFLUENCE DE FAIDHERBIA ALBIDA Del.
ET DE VITELLARIA PARADOXA Gaertn. f.
SUR LES RENDEMENTS AGRICOLES

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FDC: 26: 176.1

Deux études ont été menées, l'une en 1988 au Sénégal (DRPF-ISRA) sur l'influence de Faidherbia albida Del. (kad) sur les rendements en mil et en arachide, l'autre en 1989 en Côte d'Ivoire (CTFT-CI) sur l'impact de Vitellaria paradoxa Gaertn. f. (karité) sur le coton. Deux méthodologies différentes ont été utilisées en raison de la densité des peuplements ligneux: la première compare 6 anneaux concentriques d'une surface totale de 300 m² centrés sur le kad à des témoins hors influence de tout arbre, la seconde analyse l'évolution des rendements du coton sur une bande de 15 m de long partant du karité dans une direction où la concurrence d'autres arbres est exclue. Pour chacune des cultures l'effet de 10 arbres a été étudié.

EFFETS DE FAIDHERBIA ALBIDA Del.

Pour le mil, l'effet du kad se marque par une décroissance du rendement du pied de l'arbre vers l'extérieur (le rendement reste significativement supérieur au témoin jusque 6,3 m). Les autres paramètres agronomiques ont également été étudiés. Les observations ont été extrapolées à l'hectare et montrent que, dans des champs où le rendement moyen en mil est de 645 kg/ha, un couvert de 25% des houppiers de kad (soit une dizaine d'arbres adultes non émondés par ha ou 30 sujets/ha fortement émondés) augmenterait la production de 20% .

Pour l'arachide, dans les conditions de l'étude, le kad montre un effet dépressif pour le rendement en gousses. Rapporté à l'hectare avec une couverture des houppiers de 25% le rendement gousses passerait de 1200 à 995 kg/ha soit une perte de 17% . En ce qui concerne les fanes d'arachide l'arbre augmente leur production dans les parcelles n'ayant pas reçu de fumures organiques (+14%), il la diminue dans les autres (-10%).

EFFET DE VITELLARIA PARADOXA Gaertn. f.

Pour le coton, nous avons constaté 3 comportements différents sans pouvoir encore les expliquer: une décroissance des rendements en s'éloignant de l'arbre, une augmentation des rendements avec la distance et un accroissement de la production jusqu'à la limite du houppier puis une diminution. 50% des arbres ont augmenté légèrement la production et les autres l'ont diminué un peu plus. En moyenne, un gros karité (circonférence: 178 cm) diminue le rendement en coton de 4,3 kg soit pour 10 arbres à l'hectare et une production de 1280 kg de coton/ha une perte de rendement de 3,4%

A VEGETATION COVER MONITORING SYSTEM FOR TROPICAL COUNTRIES WITH SPECIAL REFERENCE TO SUDAN

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FDC: 182.58: 581/585: 587.7: (213): (624)

Monitoring the vegetation cover is becoming more important especially in developing countries where the increase of population has resulted in deforestation and forest degradation. The respective dynamic features are emphasized in vegetation inventory and monitoring and multiple use in the planning of the natural resources. Integration possibilities in data gathering and planning on different levels, international, national, and local are taken into account.

The design for gathering the necessary data should be in concordance with the planning levels and general efficiency requirements. Probably, remote sensing, the GIS principle and technique, and multi-phase sampling procedures will be elementary parts of the system.

This paper deals with the inventory and monitoring problems in Sudanese conditions. Multi-phase sampling with use of imageries from weather satellites, natural resource satellites, aerial photographs, and maps combined with ground measurements is discussed. The requirement for simplicity and flexibility is emphasized. Usually, the design can be described and applied in the form of two-phase sampling. Lack of remote sensing data is not regarded as a fatal obstacle for the work: the role of remote sensing is just in making the inventory and monitoring more effective. Establishment of permanent sampling plots is recommended.

MODELLING GROWTH AND YIELD OF A EUCALYPT STAND IN TROPICAL CHINA

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FDC: 914: 176.1 Eucalyptus exserta F. Muell.--01

Due to deforestation and subsequent overuse, hundreds of square kilometers in Southeastern China are subjected to severe erosion. Since the end of the 1950ties, local and regional governments have increasingly established campaigns for reclamation and improvement of the exploited areas. A frequently used species for afforestation, originating from Australia, is Queensland peppermint (*Eucalyptus exserta* F. Muell.).

Within the framework of the Chinese-German Cooperative Ecological Research Project (CERP), administered by UNESCO, we have carried out a systems analysis and computer simulation of carbon and nitrogen cycling in a planted eucalypt stand, composed of different plots with varying treatments.

The base of the current model TREEGROW is the (modified) generic simulation model TREEDYN, introduced by Bossel and Schäfer (1989). This model contains detailed systems-analytical descriptions of tree-physiological processes (photosynthesis, respiration, growth and renewal of biomass, etc.), and nitrogen mineralization and recycling.

Several computer runs demonstrate the temporal development of the research stand investigated, from planting to maturity, as a function of diverse harvesting schedules, and as a result of various weather and soil scenarios.

Since the dried leaves of *E. exserta* are suitable for burning, the villagers often collect the above-ground litter as their main source of fuel material. Simulations show the consequences of both litter removal, and protection against it, on soil fertility and hence on the productivity and stability of the forests. On the basis of the model results, some recommendations on future silvicultural measures guaranteeing sustainable timber yield (and fuel supply) are given.

ACKNOWLEDGEMENT

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MAPPING OF BIOTIC DAMAGES USING SATELLITE DATA

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FDC: 453: 585: 114.7

In spring 1987 large parts of the south "Nurnberger Reichswald" were affected by a moth calamity (Lymantria monacha). Very often this moth appears in a high number and then leads to very serious forest decline.

The caterpillar of this moth eats the needles and leaves of all tree species, preferably the needles of spruce (Picea abies) and pine (Pinus silvestris). The most serious effect of this moth calamity occurs in the pine stands of the forest district Allersberg, which is located 30 km south of Nurnberg.

The investigation is meant to determine whether it is possible to classify this biotic disease quickly as well as inexpensively. By using three Landsat Thematic mapper scenes of different dates (April 87, and April 88) it was possible to monitor the development of the disease.

Most of the training areas were defined with the help of aerial phot-interpretation. The additional information of stand conditions (for example forest management plan, soil map) was integrated by using a geographical information system (GIS).

PLANS AND CURRENT STATUS OF THE IUFRO TELECOMMUNICATION NETWORK BITNET

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FDC: 972.12 IUFRO--065

During the last decade, interuniversitary communication networks have become useful tools that facilitate communication between scientists working at universities and research stations. The interuniversitary data network BITNET, to which the IUFRO Secretariat is subscribed, stands out by its vide distribution in North America and Europe as well as by its user-friendly standard software which permits easy access by computer centres and their users.

For the IUFRO Secretariat the following two features of BITNET are important:

- Message function for immediate distribution of short messages to all connected participants.

- File transfer function for transfer of text and data files. This function allows to send out files of any kind without restriction as to the length of data records, size of the file, or character set. Quick and safe data transfer and the fact that texts to be conveyed for further handling have to be captured only one single time are the most important advantages of this function.

For the future the IUFRO Secretariat plans to set up a BITNET List Server which will allow to forward incoming information automatically to BITNET participants, who may also be grouped by fields of interest. The emphasis will be on conference announcements and, later on, literature retrieval.

For IUFRO the connection to the interuniversitary data network BITNET means access to an efficient, low cost communication system with wide distribution.

Keywords: Telecommunication system, BITNET, IUFRO

THE BIBLIOGRAPHIC DATABASE OF THE INTERNATIONAL UNION OF FORESTRY RESEARCH ORGANIZATIONS (IUFRO) AND ITS CHARACTERISTIC FEATURES

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FDC: 945.14

Since its foundation in 1892 the International Union of Forestry Research Organizations (IUFRO) has published several thousands of documents, which are of high scientific value for forestry and wood industry. They reflect the results of almost one hundred years of worldwide research activities in these fields. Storing and dissemination of this information, which is usually compiled in the form of proceedings volumes, is essential for documentary work, because these proceedings are usually edited in very small numbers and sometimes also as so-called "grey literature". Thus the access to such documents is often very difficult, if not impossible.

Bearing these facts in mind, the IUFRO Secretariat has decided, in the course of its reorganization started in January 1988, to bridge this gap by installing a database for the documentation of IUFRO literature.

The choice of the appropriate software was based on the following main items:

- The nature of literature requests received by the Secretariat.
- Time and labour needed for data capturing from monographs and all articles contained therein.
- Cost.
- Technical features and user-friendliness.
- And, last but not least, easy transferability of the data to compatible computer equipments of IUFRO Member Organizations.

Taking these conditions into account, the IUFRO Secretariat, at the end of 1989, has installed a software called "LIDOS" (Literature Documentation System) for the administration of IUFRO publications. LIDOS is a small-scale retrieval system for personal computers, designed to record unstructured data. Each file includes a list of field names, such as author, co-author, year of publication, title and keyword. These five fields are given by the system. Additional field names, e.g. conference title, venue, data, IUFRO Division, Subject Group, Project Group, etc., can be defined by the database administrator himself and can be disposed of instantaneously.

The main advantage of LIDOS is that it allows data input, storing, and updating during the same operation. It has different levels of access, protected by password. The lowest level permits only reading, the highest level provides all available features. The user is guided by menus which are displayed upon operation of the function keys.

Keywords: Database, retrieval system, user-friendliness, LIDOS, IUFRO

COMPILING A BILINGUAL MICROTHESAURUS OF BAMBOO TERMINOLOGY

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ABSTRACT

FDC: 175.2 Bambuseae--011

Bamboos are widely distributed in the tropical and subtropical areas of Asia and the Pacific, to some extent they occur in Africa and South America. Due to their fast growth, easy propagation, soil binding properties, short rotation and long fibre of culms, bamboos are ideal plants for use in afforastation, soil conservation and social forestry programmes. As a result of rapid decrease of tropical forests in recent decades much more attention has been paid to the cultivation and utilization of bamboo. Bamboo societies have been set up in America, Europe and in Asian countries. Hundreds of bamboo research papers are published annually, some 200 of them are from China.

In order to improve international exchange of bamboo research achievements the Bamboo Information Centre, supported by the International Development Research Centre of Canada and the Chinese Academy of Forestry, is compiling a Chinese cum English microthesaurus of bamboo terminology. This work will be of use for subject indexing, document retrieval and translation. The microthesaurus is originally compiled in Chinese, the English counterparts of Chinese terms are carefully selected by subject specialists in close consultation with linguists. The existing thesauruses, such as Thesaurus of Chinese Scientific and technological Terminology, Thesaurus of Chinese Forestry Termonology, Agrucultural Biological Vocabulary, Canadian Agricultural Thesaurus, CAB Thesaurus and AGROVOC are studied during compilation. The names of bamboo species, bamboo-related insect pests and diseases are put in Latin, vernacular names are not included. The microthesaurus is to be used in combination with existing ones, unavoidable overlap with other thesauruses are decreased to the minimum. Both English and Chinese entries are available.

Poster Abstracts
Résumés d'affiches
Kurzreferate füt Postersitzungen
Descripción resumida de posters

Poster abstracts have been arranged in alphabetical order of authors' names.
Les résumés d'affiches ont été disposés par ordre alphabétique des noms d'auteurs.
Die Kurzreferate für Postersitzungen sind in alphabetischer Reihenfolge der Autoren aufgeführt.
Descripción resumida de posters dispuestos por orden alfabético de los nombres de los autores.

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UNE NOUVELLE APPROCHE POUR LE DIAGNOSTIC DES RAVAGEURS EN PLANTATION DE PINS ROUGES: LE SYSTÈME EXPERT.

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Cette séance d'affichage permettra d'expliquer le processus utilisé pour modifier et adapter à la réalité forestière du Québec, un système expert pour le diagnostic des ravageurs en plantation de pins rouges, élaboré à l'Université de Madison (Wisconsin, É.-U.). Nous discuterons d'abord du choix des unités territoriales, en l'occurrence un découpage effectué selon les limites administratives et les zones écologiques du Québec. Par la suite, nous décrirons la méthodologie utilisée pour définir l'indice d'abondance des ravageurs dans chacune des unités territoriales et ce à partir des relevés d'insectes et des maladies effectués par les ministères fédéral et provincial (Forêts Canada et Énergie et Ressources du Québec). Les 21 ravageurs retenus ont été sélectionnés en considérant l'effet économique et visuel qu'ils occasionnent dans les plantations de pins rouges. Enfin, nous expliquerons comment l'utilisation d'un système d'information à référence spatiale nous à permis d'analyser les nombreuses données tirées des relevés d'insectes et des maladies que nous avons utilisés. La dernière étape de ce projet de recherche, soit la validation du système expert, devra permettre aux futurs utilisateurs d'avoir une réponse rapide et juste à des problèmes de ravageurs rencontrés dans leurs plantations.

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CAB INTERNATIONAL: FORESTRY TERMINOLOGY FOR THE FUTURE

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Two recent developments within CAB International (CABI) have a bearing on the development of a unified forestry terminology: the availability of the CAB ABSTRACTS database on CD-ROM, and intensified cooperation between CABI and other organizations in thesaurus development. (1) Compact disc technology allows the flexibility of online searching without concerns about ongoing costs or telecommunications problems. Because of low costs in use, and user-friendly search facilities, CD-ROM availability makes browsing an attractive possibility and should lead to highly intensive use of forestry and forestry-related information on the CAB ABSTRACTS database; this in turn will lead to increased terminological awareness among users. (2) The new (3rd) edition of the CAB THESAURUS, published in May 1990, is the result of close collaboration between CABI and NAL (National Agricultural Library of the US Department of Agriculture) in the development of an indexing terminology for forestry, agriculture and related fields. The CABI Forestry Bureau is actively involved in the development of a unified forestry, forest products, and agroforestry terminology for the CAB THESAURUS. Both of the above developments reflect the continuing importance of terminological issues, both for abstracting and indexing, in the work of the CABI Forestry Bureau.

603 STATISTICAL METHODS APPLICATION TO NEURAL NETWORK LEANING

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The relation between back propagation as the means to train a neural network and least squares method to estimate parameters in a nonlinear regression setting is reviewed. This relationship is extended to describe potential uses of parallel computer architectures for real time processing of data to ascertain maximum likelihood estimates of population statistics. As a concrete example of the procedures, a field sampling device is described that could process foliage samples, searching for egg masses of the spruce budworm. When samples were processed by alternate methods, these results could be used to provide additional training to the neural network software. This process would then be a means to adjust universal coefficients for local variations or biases.

604 FROM NATURE TO FOREST

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Bionics principle based on the belief - more and more frequent recently - that all our inventions are only modest copies of something that has already existed in nature and has functioned perfectly for millions and millions of years.

The task of bionics is to study and search for ideas in nature itself and transfer the solutions according to nature's example in to technical sciences and our lives. It is technically oriented, but it is because so systematic and because its methods are perfect that foresters see the possibility of introducing it and adapting it to forestry.

The most important completion in this phase would be a two-way flow of ideas and knowledge, namely not only from nature towards technical sciences but also in the opposite way from man to nature respectively from the forest - for the forest. With its systematic work, bionics will become a component part of many branches of forestry, similarly to mathematics. Forestry can expect a lot from it in the future, too.

605 AN ALTERNATIVE METHOD FOR MODELLING NON-CATASTROPHIC TREE MORTALITY

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In this paper, parallel distributed processing (PDP, also known as artificial neural network) is introduced as an alternative for modelling regular non-catastrophic individual tree mortality. A PDP system can be regarded as a procedure which attacks the problems of parameter estimation and model selection simultaneously. The similarities and dissimilarities between a PDP system and a non-linear least squared regression model are discussed. Other aspects regarding the potential use of a PDP system as an alternative to model individual tree mortality are also discussed in the paper.

606 FOREST INVENTORY AND MONITORING OPPORTUNITIES WITH SPACE AND AIRBORNE SCANNERS, GIS AND MULTI-PHASE SAMPLING TECHNIQUES

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Computers, geographic information systems, space and airborne scanner data, expert systems, and artificial intelligence offer exciting possibilities for inventory and monitoring projects. The success of their applications depends on existing conditions, a willingness to accept new approaches, human expertise and the availability of financial resources. The new technologies have the potential of providing cost effective solutions to the increasing problems of acquiring multi-resource inventories, site-specific descriptions of forests and other natural resources, and their monitoring on an annual or bi-annual basis. At the same time, high technology and flexible data management systems can result in applications of inventory data far beyond the realm of its sample base.

607 DATABASE SYSTEMS: CONCEPTS, FACILITIES AND TECHNIQUES

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Database systems have become useful during the last few years for most of the users. In addition to database systems on host computers, which are known for about 15 years, such systems have been implemented on personal computers too. Although the performance of the new personal computers is increasing periodically, it is still reasonable and necessary to use host database systems for the management of very large amounts of data. There are disadvantages like restricted access on the host machine or probably decreased comfort. But on the other side there are also important advantages like distinct separation between data management and data processing, extensive security aspects, etc.

This paper describes constructions and operations of host database systems and their delimitation to PC systems. It presents some examples in practical use of the different views of database administrator and database users. Another very important viewpoint is the presentation of the various query and retrieval techniques. Modern database systems may have interfaces to subsequent software, e.g., statistical software, etc. Finally the paper gives an overview of future developments, especially on artificial intelligence techniques.

608 STATISTICAL METHODS IN FOREST INVENTORIES: ADVANCES AND PERSPECTIVES FOR THE NEXT DECADE

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Forest Inventories in the next decade will be characterized not only by the application of further developments in statistical methods and technical innovations but also by changes in objectives.

The expected developments in the field of remote sensing will lead to more intensive application of multilevel sampling designs, even in successive forest inventories. The task of statisticians will be to develop new classifiers answering the needs of forestry and allowing the inclusion of information already available in the classification.

As forests are being increasingly regarded as endangered ecosystems, methods for surveying ecosystem components, time series analysis, multivariate analysis, geostatistical methods, and epidemiological approaches will be employed in describing changes in the forest and analyzing causes.

The development of expert systems can facilitate the planning of inventories and decisively improve their quality.

609 SCHOLARSHIP VS. TECHNICAL LEGITIMATION: POLITICIZATION OF FOREST SCIENCE

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This sociological analysis of forest science focuses on a paradox. Traditional institutions defining why things happen, what is good, and what is bad, are undermined by the advancement of scientific knowledge. Such "scientification" of policy-making does not lead to greater autonomy for science but instead opens scientific work to political control by scientific movements and powerful groups in society at large. The paradox is that scientification of policy-making generates the politicization of science.

Politicization of forest science has been, and continues to be, especially common. Scientists function as technicians when they work on problems defined by their employment units or by internal or external political movements. Forest policy problems are increasingly defined by "hybrid-communities" of "experts" drawn from concerned political stakeholders.

Standards of independent scholarship are derived from consideration of the degree to which scientific work is professionalized (relative autonomy, including control over work goals, work process, and a per-governed reputational reward structure). When professionalism is weak, employer goals will dominate, and research problems will be defined by other groups in society. Resulting knowledge will be highly politicized and scientists will serve as technicians for legitimating the policy preferences of political groups successful in controlling research agendas. Examples from research on forestry problems illustrate the politicization of forest science.

610 FOREST MAPPING WITH SATELLITE DATA IN THE BAVARIAN HIGH MOUNTAINS

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In cooperation with the German Aerospace Research Establishment a method was developed to map forest areas in the Bavarian high mountains with satellite data from Landsat Thematic mapper. The test site is located in the Alps south of Munich. The Landsat Thematic mapper scene was geometrically rectified using control points based on Gauss-Krueger coordinates and a polynom of first order (1). The signature analysis of training areas investigated the effect of various parameters such as tree species, age classes, mixture distribution and stand density. To separate the influence of illumination on the reflection of stands and to increase the classification accuracy a digital elevation model was integrated (2, 3). By combining the classification result with the digital elevation model, danger areas can be marked off for erosion research (4).

611 ARTIFICIAL INTELLIGENCE BASED DATA REGISTER A TOOL FOR INFORMATION RETRIEVAL IN FOREST RESEARCH

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"Surveying literature" often means retrieving huge amounts of information from different sources and putting it in a new place. This process can be very innefficient if speed is required in reporting the data. In the instance of the present research, information from a wide range of topics was sampled about certain tree species. This information had to be sensibly archived, updated and consulted without losing track of the bibliographical reference. My approach to solve the problem was to develop a data register for personal computers. The ideal data base program would make information retrieval both effective and easy to learn. The program I found suitable for the task was Question and Answers (Q&A by Symantec). It uses Artificial Intelligence (AI) technology for searching and retrieving from a data register by asking questions in plain written language. Furthermore, it permits us to define and interact with the search routines by incrementing or changing parameters; it is flexible, self-explanatory, user-friendly and allows creation; it does not require expertise in computer science or system analysis to use the whole package satisfactorily and it is compatible with other more advanced data base programs (eg. Dbase). Here I show the use of this AI application program for solving a common problem os scientific work: retrieving citations and their sources seen "somewhere" by simply asking a question. In conclusion I would like to call attention to the possibilities of AI technology in forest research and training.

612 THE STUDY ON CHARACTERISTICS OF PHYSIOECOLOGY OF PINUS KORAIENSIS PLANTATION FORESTS

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The Pinus koraiensis Plantation with 28 year-old was tested in Laoshan Mountain Ecological Station of Northeast Forestry University. The photosynthesis and respiration with Chlorophyll in different diections and layers were determined by Beckman CO_2 Infrared Analyser Instrument. Meanwhile, the CO_2 density in defferent layers and environmental factors (temperature, humidity, atmospheric pressure, light etc.) also were measured. It is found that photosynthesis speed (0.149 mg CO_2 M^{-2} S^{-1}) of middle layer of the canopy is higher than that of both upper layer (0.0965 mg CO_2 M^{-2} S^{-1}) and lower layer (0.405 mg CO_2 M^{-2} S^{-1}). In directions, the speed of the south is bigger than that of the north, and the daily process of photosynthesis appears "M" type. As for CO_2 density (ppm), distributes from the highest (350) over the canopy to the lowest (200) of middle canopy, then return high until to understory (360). The results show that the photosynthesis of Pinus koraiensis plantation posses high speed, closely related with environmental factors, water supply and CO_2 density. Thus this can provide a basic data for selecting suitable land and siviculturing adaptive density as fast-growing plantations.

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QUALITY OF MODELING

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The tradeoff between model characteristics (accuracy, generality, robustness, and so on) should not be accepted as inevitable. Good models manage to combine the most desirable features. Such a combination constitutes the quality of a model. If a model can be depicted as a point in space with axes representing increasing accuracy, generality, etc., then model quality can be quantified as the distance of this point from the origin. Models are not necessarily inferior to reality. After all, it is the models and not raw data that make sense out of the world around us. The quality of a model can best be judged by the constancy of its parameters rather than by its precision. Another feature of a good model is the combination of two opposite hypotheses for the same process.